

Computing today

JANUARY 1984

85p

**MACHINE
CODE
MUSIC
ON THE
APPLE:**

**6502 routines
can be
adapted
for other
systems**

**In-depth review
of the Electron –
a quantum jump
for Acorn?**

**Hi-res graphics on
the Commodore
64 explained**

**Find your files quickly
with our Atari Disc Library**

**Full screen editor
for the TRS-80**

**Plus programs
for the Spectrum, Nascom**



ADVENTURE COMPETITION
Pick your way through
our questions and win the
hardware of your choice!

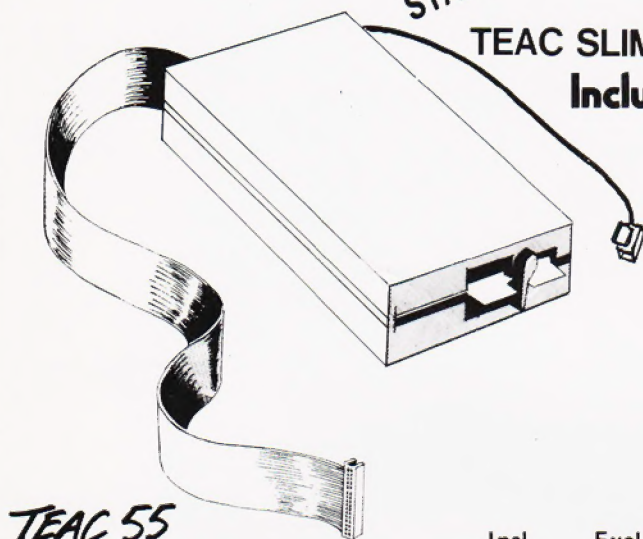
YOU CAN ALSO DO IT IN 5 SECONDS!

INVITATION TO MICRO USER SHOW
Westminster Exhibition Centre
Greycoat Street, London, SW1
Dec 8, 9, 10, 11, 1983
STAND Nos. 28-29-30

Replacing your Cassette with a Disk Drive, means DATA ACCESS in less than 5 seconds!

If you are looking for a guaranteed Disk Drive, fully BBC compatible, at a price that includes VAT, formatting disk, user manual, cases and leads, then just look at our all-inclusive prices!

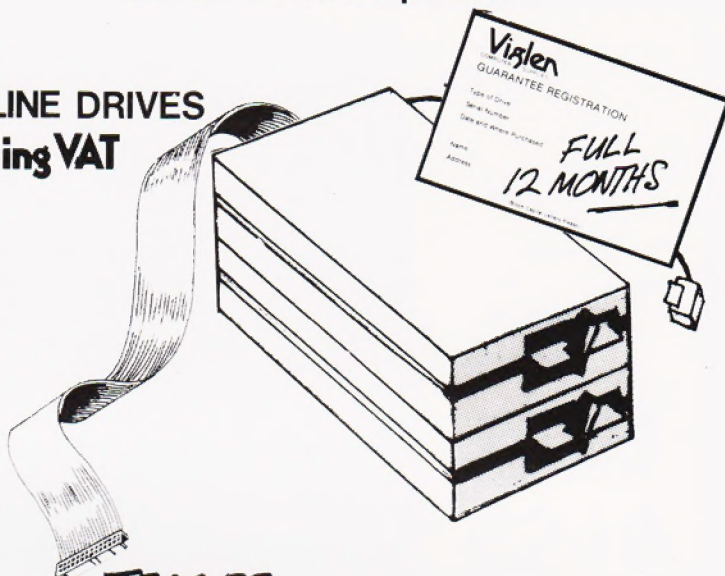
TEAC SLIMLINE DRIVES Including VAT



TEAC 55

SINGLE DRIVES CASED

	Incl. VAT	Excl. VAT
40 TRACK 100K	£166	£144.35
40 TRACK 200K	£230	£200.00
40/80 TRACK SWITCHABLE 200K	£199	£173.05
40/80 TRACK SWITCHABLE 400K	£257	£223.48



TEAC 55

DUAL DRIVES CASED

	Incl. VAT	Excl. VAT
40 TRACK 200K	£320	£278.26
40/80 TRACK SWITCHABLE 400K	£402	£359.59
40/80 TRACK SWITCHABLE 800K	£520	£452.18
DFS KIT	£75	£65.22
P.S.U.	£32.20	£28

MITSUBISHI DRIVES

	Excl. VAT	Incl. VAT
400K SINGLE DRIVE	£213.04	£245
800K DUAL	£379	£435.85
800K & POWER SUPPLY	£399	£458.85

*These drives are fully compatible with other Computers and can be used should you change your computer.

*Check our special terms for Educational Establishments and Government Departments

DEALER ENQUIRIES WELCOME

**SPECIAL
OFFER!**

**FULL HEIGHT DRIVE
£145 inc. VAT
READY TO PLUG IN**

HOW TO ORDER

BY POST

To purchase any of the items simply fill in your requirements listed above, in the coupon. Enclose your cheque/P.O. or use your Access or Barclaycard. Please make cheque payable to: VIGLEN COMPUTER SUPPLIES and post to address below, allow 7 to 14 days for delivery & add £ 8-00 postage, package & insurance on all prices.

BY TELEPHONE

-(01) 843 9903
Credit Card holders (Access/Barclay Card only) can purchase by telephone. Please give Card No, Name, Address and the item required.

**ENQUIRE ABOUT OUR 48-HOUR
GUARANTEED
DELIVERY SERVICE!**

Post to: VIGLEN COMPUTER SUPPLIES UNIT 7
TRUMPERS WAY · HANWELL · W7 2QA

Please send me the following items :

I enclose Cheque/P.O. for £ _____

I prefer to pay Access/Barclaycard
(Delete whichever not applicable)

CARD No _____

SIGNATURE _____

NAME _____

ADDRESS _____

Tel (Day) _____ Tel (Eve) _____



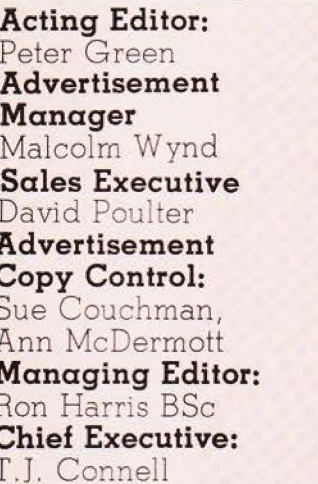
CREDIT CARDS VALID IF SIGNED BY CARD HOLDER.
ADDRESS ABOVE MUST BE THE SAME AS CARD HOLDER.

CTy. 1

Viglen

COMPUTER SUPPLIES UNIT 7 TRUMPERS WAY
HANWELL W7 2QA
Tel: (01) 843 9903





T.J. Connell

All work for consideration should be sent to the Editor at our Charing Cross Road address.

Telephone 01-437 1002-7. Telex 8811896.

Advertisers' Index.....82

CONSUMER NEWS



A WIZARD WHEEZE ▲

General Northern Microcomputers Ltd (GNOMIC) of Peterlee, Co Durham have designed the first disc interface for the Colour Genie. The interface, called the Wizard, is now rolling off the production line. Priced at £99.00, the Wizard incorporates both disc and parallel printer interfaces. The GNOMIC software team have also written a Disc Operating System, called QDOS, for the Colour Genie with Wizard interface. With a retail price of only £99.00 GNOMIC are expecting substantial sales for the Wizard, and indeed have already received export orders. For further details contact General Northern Microcomputers Ltd, 8, Whitworth Road, South West Industrial Estate, Peterlee, Co. Durham SR8 2JJ (telephone: Peterlee (0783) 860314).

AT THE ZENITH

Zenith Data Systems has launched two high quality monochrome video monitors which complement its range of desktop microcomputers and peripherals. A choice is available between the ZVM-122 amber display or the ZVM-123 green phosphor display. The new monitors offer crisp character definition and are compatible with most business microcomputers and video games, such as the Apple II and III, IBM Personal Computer, Commodore 64 and VIC 20, Texas Instruments TI-99/4A and the Atari 800 and 1200, as well as Zenith's own Z100 desktop computer.

Designed with a bandwidth of 15 MHz that gives the ability to

display more than 800 lines horizontally, the ZVM-122/123 monitors have a rise time of only 30 nanoseconds. This results in noticeably improved character definition. Special DC-coupling circuitry permits the video displays to retain their brightness even when a screen is full of information.

A special premium deflection system helps to provide a display that is easy to read. The 12 inch diagonal screen offers a large capacity display with up to 25 lines containing 80 characters each. To optimize the character presentation on the CRT, each monitor is also equipped with a 40-to-80-character switch. This enables the character size to be increased to accommodate a video format when the computer has a 40-column display.

The monitors have optional tilt-bases to permit the user to position the monitor for optimum viewing comfort and the lightweight-style makes the monitor easily portable.

The Zenith ZVM-122/123 monochrome monitors are available for a retail price of £100 for the ZVM-122 and £95 for the ZVM-123, plus VAT, per unit. Zenith Data Systems Ltd is at Bristol Road, Gloucester GL2 6EE. Telephone: 0452 29451.

HIGH STREET DISCS ►

The UK floppy disc drive distributor, Cumana Ltd, are now marketing disc drive units through well-known High Street retail outlets. This is the first time that a computer peripheral has entered the rapidly-expanding consumer marketplace through the High

Street, with appropriate packaging, point-of-sale material and full support from advertising and associated literature.

Cumana's 5¼" Japanese slimline disc drives have many attractive features to tempt the BBC and Dragon Micro users, for which they are specifically designed. Available in single-sided 40 and 80 track, and double-sided 80 track formats, the disc drives are fully assembled and tested before packaging, have a 12 month warranty, and are attractively finished in hard-wearing and robust beige steel cabinets. Each disc drive has an easy-to-use manual door mechanism, and heat dissipation without ventilation holes to prevent any risk of inquisitive young fingers poking screwdrivers into the electronics.

Cumana's design includes an independent power supply — complete with mains power supply lead and plug — enabling up to two and four disc drives to be added to the BBC and Dragon Microcomputers respectively, without any modifications to the computer or risk of it overheating.

The first Cumana disc drive purchased for the BBC Micro — addressed as drive 0 — is supplied complete with comprehensive disc user manual, two-drive connecting cable and formatting diskette. For the Dragon Micro the first Cumana disc drive purchased — addressed as drive A — is supplied complete with the disc user manual, drive connecting cable, demonstration diskette and 'Delta' ROM-based cartridge adaptor.

Packaging for the disc drives has been designed for the shelves of well-known High Street retailers, among them W.H. Smith and Spectrum UK. Full support for the new Cumana disc drives is also being given through advertising and associated literature, as well as



point-of-sale material. Point-of-sale and support literature is presented in a straightforward and easy-to-understand manner, giving the prospective purchaser a clear view of what he or she is buying without all of the usual tedious and complicated technical jargon; although, of course, full technical details are available.

Cumana is already developing dual slimline disc drives, and two versions will shortly be available to supplement the single drive market. These will be slimline disc drives placed side-by-side or 'piggy-back', in a single casing. The company plans a similar marketing strategy for these new dual disc drives, which will be in the High Street alongside the single disc drives in the near future.



OH BROTHER ▲

Lowe Computers of Derbyshire, distributors of the Colour Genie, have signed a major distribution deal with Brother Industries of Japan. At £169.95 (including VAT) from Lowe or one of their Genie Specialist dealers, the new machine will be well within reach for every type of micro user, from the computer whizz-kid to the accountant or businessman tired of juggling pen, paper and calculator on BR's crowded commuter lines.

The new machine is a dot matrix thermal or ribbon printer with a comprehensive QWERTY keyboard and 12-digit calculator. The keyboard features a versatile second shift for accents required in all Roman-script European languages and a range of signs for arithmetical or chemical formulae, including automatic superior and inferior numerals. It even makes sure you don't put an accent over the wrong letter.

Correction facilities include a 32-character buffer and a 16-character screen display with cursor-controlled insertion, deletion and overtype. A 2K continuous memory stores about an

A4 page of text with displays for corrections and remaining memory and, most important for computer users, interfacing capability with a computer's disc or tape memory.

By integrating an RS-232 type serial interface into the EP-22, Brother have produced a sort of personal computer printer/typewriter. With any other comparable printer at more than twice the price, the EP-22's clear thermal or ribbon printing and interfacing memory will come as a boon to those who need an affordable first printer or a portable addition to either print or typewriting facilities.

More details can be obtained from Lowe Computers Ltd, Chesterfield Road, Bentley Bridge, Matlock, Derbyshire DE4 5LE (phone 0629 4995/4057).

MODEMS FOR NEWBRAINS

A characteristic of the Newbrain is that its video output turns off while accessing its communications port. This renders it next to useless for acting as a terminal in any application. The solution to this is an independent RS232C port on the main expansion bus. This leads on to the question of how to drive it and what to do with it. A package called "Comm Software" has been developed by Kuma to enable the new RS232C port to couple up to a Modem or Acoustic Coupler and access any bureau computer or electronic mail service.

To date this combination has been proven on Telecom Gold, Comet and many other 300 baud services over BT telephone lines. Work is taking place on providing the viewdata facility on Prestel.

The cost of the device is £69.50 plus VAT. It allows software selection of any baud rate and comes with all the handshakes necessary for communications work. An external power supply for the interface is £6.95 plus VAT.

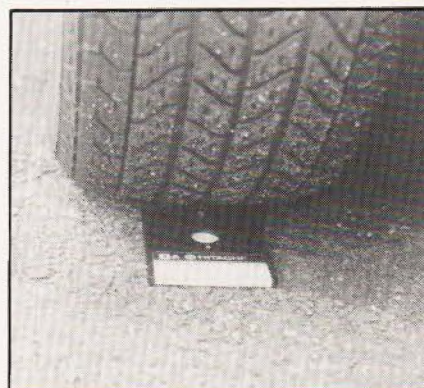
Details of the Comm Software are as follows. The software is written in machine code for maximum performance (made possible by Kuma's Zen Editor/Assembler) and allows the user to define all the usual parameters such as baud rate, parity, stop bits etc. It has various additional features such as split baud rate (vital for Prestel) and a self-defining baud rate for non-standard applications. Prompts and a status line giving useful information make this program very easy to use. The superb

typeface of the Newbrain makes it a very attractive terminal. The cost of this cassette-based software is £29.50 plus VAT. For more details contact Kuma Computers Ltd, 11 York Road, Maidenhead, Berks SL6 1SQ (phone 0628 71778).

DISC DRIVE MARK II ▼

Having shown how floppy disc storage cases can withstand motor vehicles (see News last month), other people are now getting in on the act. AMS graphically demonstrated the durability of their own 3" discs by — surprise! — driving a motor car over them. The new discs are encased in plastic sleeves holding 100K per side. Nick Pearson, marketing director of AMS (Advanced Memory Systems Ltd) commented. "We knew these new discs were really strong so we put a couple in the road and drove over them at various speeds up to 60 mph. Not only were they not cracked or anything but worked perfectly when we used them in the drives. We don't recommend everyone doing it but if they can stand up to that sort of punishment they'll withstand anything that schools, companies or the general public hand out".

The 3" disc also features an automatically retracting steel shutter to protect the disc surface, and an overwrite switch protection. The drives (made by Hitachi and housed by AMS in rigid steel, so they probably stand up well to heavy traffic too), come in two configurations: a £225 single drive 100K or a £399 dual drive 200K including cables, VAT and delivery. They use the BBC Micro power supply. The 3" Hitachi drives have an industry-standard interface, so they are electronically identical to 5¼" drives but of course a quarter of the size and with a superior disc system. The drives are 40 track with a track-to-track access time of 3 ms and average access time of 55 ms.



COMPUTER ROBOTICS TRAINING

FULL TIME COLLEGE COURSE

SUITABLE FOR APPLICANTS WHO WISH TO ENTER COMPUTER SERVICE OR RELATED INDUSTRIES — HIGH PERCENTAGE OF PRACTICAL COURSE WORK

15 MONTHS

TEC Certificate in Computing Technology

9 MONTHS

TEC Higher Certificate in Computing Technology

Subjects: Foundation Electronics, Digital Techniques, Microelectronics, Microprocessors, Microcomputer Based Systems, Industrial Robotics, Machine Code & High Level Programming.

Shortened courses can be arranged for applicants with previous knowledge.

Courses commence Jan, April and Sept (Higher Cert Sept only). Prospectus from:

LONDON ELECTRONICS COLLEGE (Dept C5/6)
20 Penywern Road,
Earls Court, London SW5 9SU.
Tel: 01-373 8721

AB & C Computers

MAIL ORDER SPECIALISTS

SEND LARGE SAE FOR LISTS
INSTANT CREDIT FOR CALLERS

A SELECTION FROM OUR EXTENSIVE STOCK

★TEXAS SPECIAL OFFER PACKAGE★

T199/4A Computer + Extended Basic including Delivery **£165.95** whilst stocks last.

Titch Software for T199/4A Hangman/Victory 4 Super Value at **£8.00**

Protek Spectrum Joystick Interface **£14.95** inc. P&P. Uses most switch type Joysticks.

New Oric Joystick Interface **£14.95** inc. P&P.

New MCP-40 Centronic 4 Coloured Printer fits most personal Micros **£149.95** inc. P&P.

ZX Spectrum & BBC Upgrades

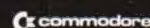
Now in stock **DRAGON DISC DRIVES £275.00 + £5. Delivery**

New low prices on Texas T199/4A. Contact us first.

Are you short of a cassette recorder for Xmas — for your computer. **CONTACT US**

Send Cheque with order made payable to AB & C Computers
Duchy House, 6 Lower Aylmer Square, St Austell, Cornwall.

TWICKENHAM COMPUTER CENTRE LTD



Buy the **BEST**
BBC Model A
£299
BBC Model B
£399

ALL PRICES INCLUDE VAT!
*VAT Paid

Wordwise Word Processor
Software — Acorn, Bugbyte, Computer Concepts
Acornsoft on Disk • Digitiser Graphics Plotter
Joysticks for the BBC • 100K Single Disk Drives
BBC 800K Twin Disk Drives
Torch 800K Twin Disk Drives with CPN

As supplied to schools, local authorities and government departments by the leading BBC/Acorn dealer & service centre

We stock all the extras:
Floppy disk interface
Econet network interface
Voice synthesis circuits
Cartridge ROM pack interface
Alternative high-level languages
Cassette recorders
Dot matrix printers
Daisywheel printers
Teletext & Prestel units
Monitors + Disk drives
(Subject to availability)

Another British best!

Ceedata 8200 Word Processor
FROM £1,995

64K Internal Memory (up to 256K optional) + Twin floppy disk drives + 60 self programmable keys (all set for Wordstar) + cables + user manual + C/PM manual + C/PM software with utilities + keyboard overlays available.

* Commodore 64: £229

* Apple IIE 64K on special offer — phone for latest price

Now in stock: Acorn Electron **£199**

ACORN SOFTWARE for the BBC

Peeko-Computer Pack	Arcadians
Algebraic Manipulation Pack	Sliding Block Puzzles
Creative Graphics Cassette	Cube Master
Graphs & Charts Cassette	Chess
Desk Diary	
Philosopher's Quest	
Sphinx Adventure	
Monsters	
Snapper	
Planetoid	

Books for the BBC:

Creative Graphics	
Graphs & Charts	
LISP on the BBC	
FORTH on the BBC	

£9.95 EACH

£7.50 EACH

Daisywheel Printer for BBC (complete with interface) £385

Star 510 Dot Matrix Printer
Star 515 Dot Matrix Printer
Brother Daisywheel Printer
Juki Daisywheel Printer
Black & White TV with Monitor conversion 12" or 14": £55
Cassette Deck (BBC compatible): £30

Acorn/BBC Main Distributors — Trade Enquiries Welcome

Twickenham Computer Centre

72 Heath Rd Twickenham Middx TW1 4BW (Tel: 01-891 4991)

Delivery extra
— nationwide
by Securicor

BBC MICRO & DRAGON 32 NOW AVAILABLE

"CLASSIC GAMES" — BBC MICRO
"MASTER CHESS" — DRAGON 32

These superbly produced programs are, we believe, the first chess magazines on tape currently available in the U.K. Issue 1, November 1983, includes the following:

Bronstein — Rojahn: Moscow Olympiad 1956: Two Knights Defence

Tal — Van der Wiel: Wijk-Aan-Zee 1982: English Opening

Iskov — Lein: New York 1981: Caro-Kann Defence

Opochenksy — Ivkov: Bogaska Slatina 1948: Queen's Gambit

Supplied on top quality "Agfa" tape. Detailed audio commentary included

Coming next month

Kotov — Spassky: Sochi 1965: Bay Ligez

Richter — Kretschmar: Berlin 1926: Voroslov System

Stahlberg — Ojanen: Trencianske Toplice 1969: Queen's Indian Defence

Karpov — Korchnoi: Leningrad 1974: Sicilian Defence

We also supply hardware interfaces for Dragon 32 and a range of specialist educational software for BBC Micro Dragon 32.

SEND LARGE S.A.E. FOR CATALOG

"Classic Games" for BBC Micro — **£8 + VAT**

"Master Chess" for Dragon 32 — **£8 + VAT**

Please include £1 p & p

Cheques, PO payable to Prelectronics Ltd. Send to:

PRELECTRONICS LTD.,
ALBRO CASTLE, ST. DOGMAEL'S, CARDIGAN,
DYFED, WALES.

AT LAST, A HOME COMPUTER THAT IMPROVES WITH AGE.



It's surprising how many first-time relationships with a home computer go sour with age.

You buy an attractive, discounted little machine so that you and the children can learn about computers.

Instead, you learn about its limitations: the dull graphics. The plugs that fall out. The cheap power supply. The unalterable "beginners" language. The stiff, fragile keys. No provision for future developments. If only you'd looked around a bit in the beginning... "Quality costs a little more, but it's usually worth paying for" (Personal Computer News—CGL M5 Review, June '83.)

The CGL M5 is designed and built by Sord, one of Japan's leading computer specialists, with three main ideas in mind.

First, to be easy and fun to learn and operate.

Second, to be rugged enough to last through hours and hours of operation.

And third, to form the basis of a powerful, versatile home computer system that won't need replacing until you're ready for a dedicated business system.

Built to learn

The CGL M5 is designed to be easy for non-geniuses to use.

"On the M5, most of the work is done for you, and all that is left is the need to work out what to do next, rather than how to do it." (Personal Computer News, June '83.)

If you make a mistake, you can correct it with a simple movement of the cursor. So you only correct that mistake, not a whole line; nor do you have to indulge in complex edit commands.

Budding video game designers and computer artists will love to get their hands on the 16 colour graphics and 32 moveable images called "sprites."

"The M5 makes professional graphic

effects very simple for even the beginner to achieve." (Personal Computer World, Aug. '83.)

Built to last

"It works first time, doesn't need a lot of mollycoddling and jiggery-pokery to persuade it to continue to do so, and what's even better, it continues to work well. You don't have to balance cold cartons of milk on the top, shove matches in the back to keep the plugs in, or press the keys with several pounds force to make them respond" (Personal Computer News, June '83.)

Being able to build things that work and carry on working without endless maintenance is something at which the Japanese seem to excel.

Built to grow

To be truly versatile, a home computer has to understand very different things.

So you need different "languages," which the M5 provides by supplying part of its memory in plug-in cartridges.

"The M5 eliminates the worst limitations on machines at this level, which is that they tend to be stuck with whatever language is provided by the management." (Personal Computer News, June '83.)

The computer is supplied complete with a Basic-I cartridge, a standard integer BASIC language and a simple learning text.

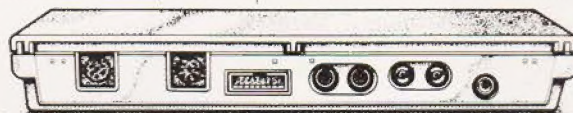
Plug in the Basic-G cartridge, and you can access the M5's incredibly sophisticated graphic and sound capabilities which are far in advance of similarly-priced computers.

Move on to the Basic-F cartridge, and you have scientific, technological and statistical computing power usually available only

on big computers with equally big price tags.

The FALC cartridge provides a tailor-made language for data management, spreadsheet accounts and business problems. Combine FALC with a disc and you could "turn the M5 into a small business machine" (Personal Computer Magazine, August '83.)

Now, take a look at the back of the M5.



Notice the sockets (usually an extra) for a standard

Centronics-type printer, the separate video monitor and hi-fi sound output.

Even the language cartridge socket has hidden potential:

"Unlike most such sockets, this one has 56 internal lines connected to it giving access to just about every function in the computer. This means that just about everything you can think of can be added onto the computer, ranging from a Prestel interface to second processor to use as an intelligent terminal on a timesharing computer." (Electronics—The Maplin Magazine, March '83.)

Take a look at the home computer that will improve with age.

For a full technical specification of the CGL M5, details of the wide range of supporting software and to find out where to see a complete demonstration, send the coupon to: CGL, CGL House, Goldings Hill, Loughton, Essex IG10 2RR. Telephone number: 01-508 5600.

I'd like to know more about the CGL M5. Please send me a brochure and a list of dealers.

CT3

Name _____

Address _____

CGL M5
HOME COMPUTER

BUILT TO LEARN. BUILT TO LAST. BUILT TO GROW.

SOFT WARES

EPSON QX-10 GRAPHICS

A business graphics program has been launched for the Epson QX-10 desk top micro which offers the extent of versatility previously only available on mainframes. Known as Dataplot III, and developed by Grafox Limited of Oxford, the package uses data from standard format files, such as those produced by the Supercalc or Peachcalc spreadsheet programs, to produce graphs of any scaling, size, style and type including bar charts, histograms, scattergrams, line graphs and pie diagrams. Up to seven different sets of data may be illustrated at any one time and each of these may employ a different graph type. Multiple graphs can also be shown simultaneously and two independent Y-axes are available to allow sets of data with totally different scales to be placed on the same screen.

Specially-featured in the package is a unique 'parameter assignment' facility which provides for extensive manipulation of data by allowing the user to design statistical and scientific formulae which can be applied to the data before it is graphed. Further details are available from Grafox Ltd, 35 St Clements, Oxford OX4 1AB (telephone 0865 242597), or from Epson (UK) Ltd,

Dorland House, 388 High Road, Wembley, Middlesex HA9 6UH. Telephone: 01-902 8892. Telex: 8814169.

NEW DOS FOR MSX

Microsoft Corp, developers of the 16-bit MS-DOS and IBM Personal Computer DOS operating system, has announced a new eight-bit operating system for MSX microcomputers. Called MSX-DOS, the operating system is designed for MSX microcomputers and will be available to the 14 Japanese and one US microcomputer manufacturer now committed to the MSX standard. The first machines with MSX-DOS will appear in January 1984.

MSX-DOS is CP/M-80 2.2 compatible and runs all Microsoft's eight-bit software including the languages MBASIC, COBOL-80 and FORTRAN-80. Microsoft's Multiplan also runs on MSX microcomputers under MSX-DOS. MSX-DOS supports all MSX hardware including 32, 40 and 80 column text modes as well as MSX-BASIC, an enhanced version of Microsoft's GW-BASIC. MSX-DOS occupies 8K of memory, and includes Microsoft's popular M-80 assembler.

"MSX-DOS was developed in response to the tremendous demand for a Disk Operating System (DOS) from the Japanese

MSX manufacturers, who wanted a DOS with the standard MS-DOS disc format and user interface," said David Fraser, Microsoft Ltd's General Manager. "As well as supporting the popular disc drive sizes (5¼" and below) MSX-DOS specifies a common disc format across all machines — something CP/M-80 never did," he added. MSX-DOS supports any type of size of diskette including 3", 3½", 5¼" and 8", with the ability to read discs created by MS-DOS.

This compatibility with MS-DOS means two things. First, users familiar with MS-DOS machines will be instantly able to use a MSX micro with MSX-DOS. The user interface, command structure and command syntax are identical. Second, data is transferrable between MS-DOS and MSX machines without the need for translation utilities or other extras. Multiplan, for example, runs under both MSX-DOS and MS-DOS and data discs can be transferred and updated between machines running these operating systems as required.

One of the grave shortcomings of CP/M-80 was that a program had to be produced in a different format for each microcomputer. MSX-DOS specifies one disc format, common across all microcomputers, thus reducing costs in producing software, and passing these savings on to the user.

The MSX specification was first introduced by Microsoft in June 1983. It provides a standard hardware and software specification for low-end eight-bit microcomputers that will make a range of software compatible with low-cost computers from different manufacturers.

XENIX FOR ACORN

Logica UK Ltd has signed a contract with Acorn Computers Ltd to port the XENIX operating system to a new processor due from Acorn in the Spring of 1984 (now where have we heard that one before?). The 32-bit second processor is designed as an add-on processor for the BBC microcomputer, designed and manufactured by Acorn, and is based on National Semiconductor's 32-bit 16032 microprocessor.

TAKE IT APART

Henry's of Edgware Road, the long-established specialist hardware supplier and main



distributor for the Gemini Galaxy range of computers, has entered the software market with the introduction of MDIS, an intelligent dis-assembler. Developed for all CP/M based machines, MDIS is a low-cost package which can be used to take apart CP/M machine code programs for examination and/or modification. Using the correct mnemonics in each case, it will, for example, dis-assemble both the Z80 and 8080 machine codes.

Labelling is automatic and tables are dealt with in an intelligent fashion by reporting data areas in 'defined byte' form with an ASCII printout alongside. As a result, the programmer is given the opportunity to decide whether the table is a text string or access table. The dis-assembled output is entirely compatible with the Microsoft M80 assembler and L80 linker and as the input command syntax has been designed to be similar to Microsoft utilities, MDIS is easy to use. In addition, the MDIS output may be either to disc or hard copy and can be edited without difficulty into forms suitable for assemblers other than Microsoft types.

MDIS is available at £50 plus VAT from Henry's, the sole worldwide distributor who would be pleased to arrange a demonstration to show the program's capabilities. Henry's is at 404-406 Edgware Road, London W2 1ED. Telephone: 01-402 6822.

COMPUTER COURSES

Four new low-cost courses in computer studies are being introduced by the Open University, as part of its non-degree studies. The courses feature programming, systems analysis and design, and the principles of data analysis. All four courses are suitable for study at home, or use by educational establishments, business groups and user groups, and include exercises and self-assessment questions to monitor students' progress.

Structured Programming with UCSD Pascal is intended for the many people who require training in problem-solving techniques enabling them to design and implement software. Also suitable for home micro users who have a UCSD Pascal compiler, the course costs £65.

Introduction to Commercial Data Processing with COBOL uses the most popular business language and is aimed at those

with little computing background. Ideal for in-house training as well as for the home-user the course gives a complete introduction to the subject. On-line access to the Open University's Academic Computing Service through a local study centre is available for those without computing facilities and the course fee in this instance is £175; for micro users with a COBOL compiler the cost is £130. Both the UCSD Pascal and the COBOL courses involve approximately 100 hours' study time.

Programmers and prospective systems analysts will find **Introduction to Systems Analysis and Design** an ideal course to take them a step further in their careers but it would be equally useful for managers and administrators wishing to gain a greater insight into the subject. The fee is just £50 and unlike the other three courses, this course has no practical computing element. Material for the 40-hour course includes video and audio cassettes, a study guide and reference handbook.

Data Analysis for Information Systems Design will appeal to data base systems managers and to analysts, in fact anyone requiring a grounding in the principles and skills of data analysis. This course, like all the three other courses, can be followed at a pace to suit the student and involves between 40 and 50 hours of study. If required, on-line access of up to five hours is available via OU study centres, in which case the course fee is £110 (£95 if using your own terminal).

For more detailed information on all these courses, or to enrol, contact the Student Enquiry Office, The Open University, PO Box 71, Walton Hall, Milton Keynes MK7 6AG.

ABERSOFT GOES AUSSIE

All publishing rights to Abersoft FORTH, the version we are using in our teach-yourself series, have been secured by publishers Melbourne House who will be producing new documentation on this high level language in the next few weeks.

Already hailed as being the package which is by far the best implementation of FORTH for the ZX Spectrum (that's why we picked it), Abersoft FORTH makes it possible to run programs between 10 and 50 times faster than those written in BASIC, without the tedious programming requirements

of machine language. It is even possible to re-write the language to suit individual programming applications. It is, say Melbourne House, the tool for programmers who want to squeeze maximum power from their Sinclair Spectrum. Available early November, Melbourne House, Abersoft Forth costs £14.95. The Melbourne House sales office is at 224 Stanley Road, Teddington, Middlesex TW11 8VE. Telephone: 01-977 9160.

GAMES WITHOUT FRONTIERS

With well over 1,000 titles of games software constantly in stock in their nine (soon to be 10) branches, Games Centre are now established as Britain's largest supplier of games software to the general public. Not satisfied with coping with the demand in this manner, Games Centre also offer their entire stock through their mail order department. Their 1983/84 Mail Order Catalogue is now ready and obtainable from the Mail Order Department, Games Centre, 22 Oxford Street, London W1A 2LS.

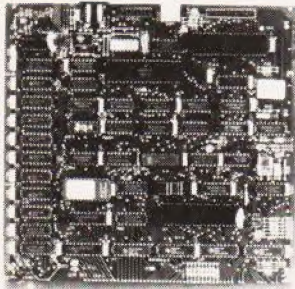
SPECTRUM PASCAL COURSE

Owners of 48K Spectrum owners who are interested in Pascal may wish to attend a course of fourteen weeks duration to be held on Monday, January 9, 1984 at the East Ham College of Technology, High Street South London E6 4ER. The course is intended to introduce Spectrum owners to programming in Pascal using the Hisoft Pascal 4T-version 1.5 compiler.

Students will use their own Spectrums and tape recorders but monitors (TV sets) are provided. The course fee will include the compiler tape and programmers manual. The internal course of study is as follows, week by week: Introduction to the Compiler and Editor; Pascal Syntax and Data Types; Control Structures; Procedures and Functions; Parameters; Formatting; 'Case' Statements; Arrays and Strings; Records; Pointers and Linked Lists; The GOTO statement and use of ZX Printers; Team Programming Project — 1; Team Programming Project — 2; Evaluation and Discussion.

Further details can be obtained from B.F. Boakes, Course Tutor. Telephone: 01-472 1480 ext 249.

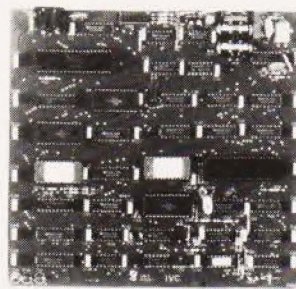
MicroValue 80-BUS MULTIBOARDS



GM813—CPU/64K RAM Board

- * 4MHz Z80A C.P.U. * 64K Dynamic RAM
- * RS232 Interface * Two 8-Bit I/O Ports
- * Cassette Interface
- * Extended & Page Addressing Modes
- * CP/M Compatible Monitor

£225



GM812—Video Controller Board

- * 80 Characters x 25 Line Display Format
- * On-board Z80A Microprocessor
- * Buffered Keyboard Input
- * Programmable Character Generator
- * 160x75 Pixel Graphics
- * Light Pen Input

£125

GM811—CPU Board

- * 4MHz Z80A CPU
- * 4 'Byte-wide' Memory Sockets
- * 2x8-Bit Input/Output Ports
- * 8 Bit Input Port
- * RS232 Serial Interface
- * Cassette Recorder Interface

£125

GM803—EPROM/ROM Board

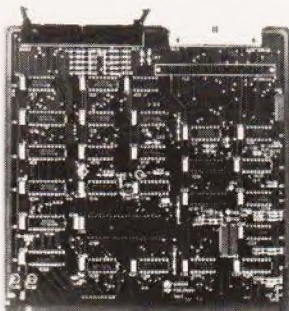
- * Up to 40K of Firmware
- * 2708 or 2716 EPROMS
- * Page Mode Operations

£65

GM802—64K RAM Board

- * 64K Dynamic RAM
- * 4MHz Operation
- * RAM Disable Function
- * Page Mode Operation

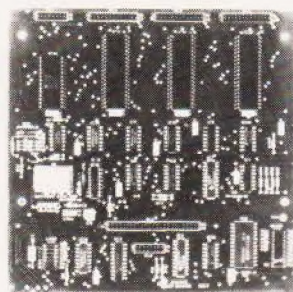
£125



GM829—Disk Controller Board

- * Up To 4 Mixed 5.25 & 8" Drives
- * SASI Hard Disk Interface
- * Single & Double Density Operation
- * Single & Double Sided Drive Support
- * Supports 48 and 96 TPI Drives

£145



GM816—Multi I/O Board

- * 6 I/O Ports
- * 4 Counter/Timer Channels
- * On-Board Real Time Clock
- * Battery Backup
- * Further Expansion Capability

£125

MP826—Static RAM Board

- * 32K Static RAM
- * Battery Backup
- * Page Mode Operation

£185

EV814—IEEE488 (GPIB) Controller

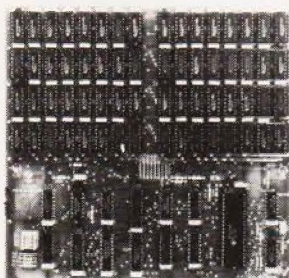
- * Cost Effective Controller
- * Comprehensive Software Supplied
- * Full Implementation
- * Easy To Use

£140

GM827—87 Key Keyboard

- * User Definable Function Keys
- * Numeric Keypad
- * Cursor Control Keys

£85



GM833—RAM-DISK Board

- * Virtual Disk Operation * 512K Dynamic RAM
- * Port Mapped For Easy Interface Software
- * Over 10 Times Faster Than a Floppy Disk

£450

Please note: This board cannot be used as a conventional RAM board

PLUTO—Colour Graphics Board

- * On-Board 16 Bit Microprocessor
- * 640x576 Bit Mapped Display
- * 192K Of Dual Ported RAM
- * Comprehensive On-Board Software

£399

CLIMAX—Colour Graphics Board

- * 256x256 Pixel Display
- * 16 Colours
- * Ultra-fast Vector & Character Generation
- * Light Pen Input
- * UHF or RGB Outputs

UHF Version

£199

UHF & RGB Version

£220

GM839—Prototyping Board

- * Fibreglass P.C.B.
- * 80-BUS Signal Identification
- * High Density IC Capability

£12.50



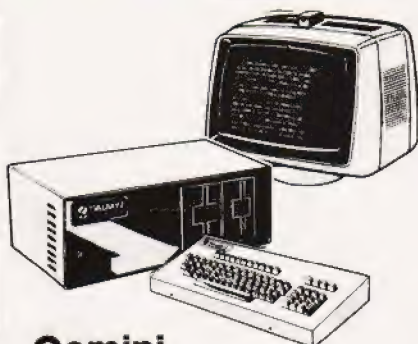
All the boards and components in the 80-BUS range are fully compatible and offer a very flexible and cost effective solution to your computer needs. For further information about the 80-BUS range contact your nearest MICROVALUE dealer.

MicroValue - MicroValue



Power Supplies, Mother Boards & Frames

* GM807 3A Power Supply	£40.00
* GM817 6A Switch Mode P.S.U.	£75.00
* GM843 10A Switch Mode P.S.U.	£95.00
* GM656 3 Slot Motherboard	£5.00
* GM654 5 Slot Motherboard	£6.00
* GM655 8 Slot Motherboard	£10.00
* MP840 14 Slot Motherboard	£47.00
* GM662 5 Board Frame	£50.00
* GM610 19" Frame	£37.50



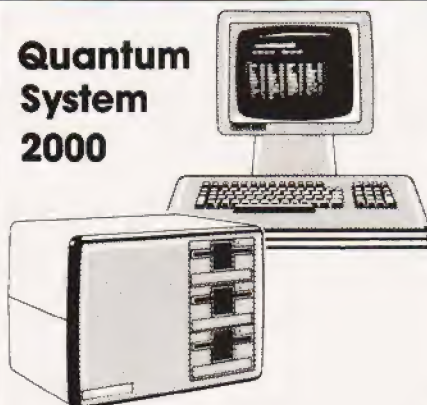
Gemini Galaxy 2

"I would place the Galaxy at the top of my list"
(Computing Today, April 1983)

- * Twin Z80A Processors
- * CP/M 2.2 Operating System
- * 80x25 Video Display
- * 64K Dynamic Ram
- * Light Pen Interface
- * Up to 1.6Mhz Disk Capacity
- * Serial RS232 Interface
- * Parallel Interface
- * Numeric Keypad
- * Definable Function Keys
- * Cassette Interface
- * 12" Monitor Included

from **£1495**

Quantum System 2000



Computerise Without Compromise

- * 80-BUS Construction
- * Serial & Parallel Interface
- * Stylish Design
- * Up To 2.4Mhz Disk Capacity
- * Up To Three 5.25" Drives
- * Fully Expandable
- * Twin Z80A Processors
- * CP/M Operating System
- * 64K Dynamic Ram
- * Definable Function Keys

Two-Drive Quantum £1910

Gemini Multinet

The Gemini Multinet enables as many people as possible to have access to their own microcomputer with mass storage and printer facilities for the lowest possible cost. This is achieved by providing a central 'filesaver' fitted with a Winchester hard disk unit and printer interfaces, in conjunction with a method of interconnecting up to thirty-one workstations to the filesaver. The filesaver and each station are fitted with the Gemini GM836 network interface board. A Micropolis 800K floppy disk drive is incorporated in the filesaver providing backup for the hard disk.

GM910 Galaxy 4 Multinet 5.4 M/byte filesaver	£2600
GM912 Galaxy 4 Multinet 10.8 M/byte filesaver	£2850
GM909 Galaxy 4 Multinet workstation	£650

Both filesavers and workstations are supplied complete with VDU's; the operating software is supplied with the filesaver.

Phoenix P12 Monitor



A high quality 12" data display monitor, ideal for Gemini systems. The P12 is available in both green and amber phosphor versions and has a resolution of 20Mhz.

£95

BUY FROM THE COMPUTER PROFESSIONALS

MICROVALUE DEALERS:

AMERSHAM, BUCKS
Amersham Computer Centre,
18 Woodside Road,
Tel: (02403) 22307

BRISTOL
Target Electronics Ltd., 16 Cherry Lane,
Tel: (0272) 421196

EGHAM, SURREY
Electrovalue Ltd.,
28 St. Jude's Road, Englefield Green,
Tel: (07843) 3603

LEEDS
Leeds Computer Centre,
55 Wade Lane, Merriam Centre,
Tel: (0532) 458877

LONDON W2
Henry's Radio, 404 Edgware Road,
Tel: 01-402 6822

LONDON SW11
OFF Records,
Computer House, 58 Battersea Rise,
Clapham Junction,
Tel: 01-223 7730

MANCHESTER M19
EV Computing, 700 Burnage Lane,
Tel: 061-431 4866

NOTTINGHAM
Computerama, (Skytronics Ltd.)
357 Derby Road,
Tel: (0602) 781742

Telephone orders welcome



MicroValue

REAL value - from the Professionals



Software News

INNOVATIVE
IBM SOFTWARE



from the professionals

Mysterious Adventures NOW — FOR THE IBM PC

An absorbing and stimulating collection of mind provoking games styled after the original mainframe Adventure. Mysterious Adventures are now available for most of the major microcomputers. There are ten of them at the moment, three more are to be released shortly. A short synopsis of each follows:

1. THE GOLDEN BATON — Venture into a strange province of Sorcery and Evil Magic to recover the Golden Baton, a priceless artifact whose powers are said to bring great Health and Prosperity to the Land.
2. THE TIME MACHINE — As a Newspaper reporter you are sent to investigate the eccentric professor who lives in the old house on the Moors. What is his secret and why is his house now deserted?
3. ARROW OF DEATH (Pt. 1) — A blight has fallen on your homelands, the Baton has become tarnished and now radiates a malevolent aura of Evil. Your mission is clear — trace the source of this Evil and destroy ... or be destroyed. This is the first part of an Epic Adventure although each part can be played as a stand alone scenario.
4. ARROW OF DEATH (Pt. 2) — You now have the means to destroy your enemy ... but you are far from home and this land is strange to you. Can you cope with the deadly perils which approach you and have you the strength to see your mission through to the final conflict?
5. ESCAPE FROM PULSAR 7 — Alone on a gigantic Space-Freighter ... The rest of your crew have died horribly at the hands of a mutated Zoo-Specimen. Your only chance of escape is to reach the Frail Shuttlecraft. But the lurking Monster is hungry and you are the only food it has left...
6. CIRCUS — Your Car has run out of Petrol on a lonely road miles from habitation. As you trudge reluctantly down the road in search of help you are suddenly confronted by an amazing sight ... in a nearby field is a Huge Circus tent! But this is no ordinary Circus as you will soon discover...
7. FEASIBILITY EXPERIMENT — Far across the gulfs of time and space, a dying race of super-intelligent beings search the Universe for a Hero to save their existence ... At length their thoughts turn to planet Earth. You are chosen to be their saviour in a bizarre scenario where death is a mere thought away...
8. THE WIZARD OF AKYRZ — You are in the Royal Palace. The King beseeches you to rescue his daughter from the evil wizard. If you succeed your reward will be priceless ... failure will bring certain death.
9. PERSEUS AND ANDROMEDA — Travel into the realms of ancient mythology. Battle with grotesque monsters and supernatural powers as you search for the hidden secrets of myth and legend.
10. TEN LITTLE INDIANS — This mystery begins with a train journey into a strange country. What secrets are held by the strange country mansion? What meaning is attached to the strange idols? Maybe you will find out if you live long enough...

IBM Mysterious Adventures are sold only on disk

Any one Mysterious Adventure ... **£14.50** plus VAT = **£16.68** plus 75p p&p
Any 5 Mysterious Adventures (on 1 disk) ... **£55.00** plus VAT = **£63.25** plus 75p p&p
All 10 Mysterious Adventures (on 2 disks) ... **£100.00** plus VAT = **£115.00** plus £1.50 p&p

IBM DEALER ENQUIRIES WELCOME

JUST ARRIVED: Contact us on the telephone for details of Data Writer the **low cost** approach to database management on the IBM.

TEL: [0424] 220391/223636

MOLIMERX™ LTD

TELEX 86736 SOTEX G

A J HARDING (MOLIMERX)

1 BUCKHURST ROAD, TOWN HALL SQUARE, BEXHILL-ON-SEA, EAST SUSSEX.

NEXT MONTH

Computing today

FEBRUARY ISSUE
ON SALE
JANUARY 13th

SPECTRUM MACHINE CODE

Would you look forward to assembling a few thousand bytes of Z80 machine code using paper and pencil only? No, neither did one of our contributors, so he started looking around for books and software tools to help him in his task. Next month we'll be telling you some of the products he tried and what he finally settled on to do the job. If you want to get to know the language at the heart of your Spectrum, it's required reading.

MULTI-TASKING ZX81-FORTH

Still on the subject of mucking about with Sinclair products, our second feature explains how to give your ZX81 a heart transplant. Out with the old ROM, in with the new — and you have a cheap system that runs multi-tasking FORTH. Apart from speeding up the old machine out of all recognition, this new FORTH ROM provides a multi-tasking facility that allows up to 10 jobs to be run simultaneously. Sounds too good to be true? Read our review in the February Computing Today.

SOUNDING OFF ON THE COMMODORE 64

Our third and final part of the 'Getting more...' series examines the sound capabilities of the Commodore 64 and delves into the mysteries of the control registers. Not only do we tell you what's going on, we correct some of the errors in the User Manual. A must for all Commodore 64 programmers.

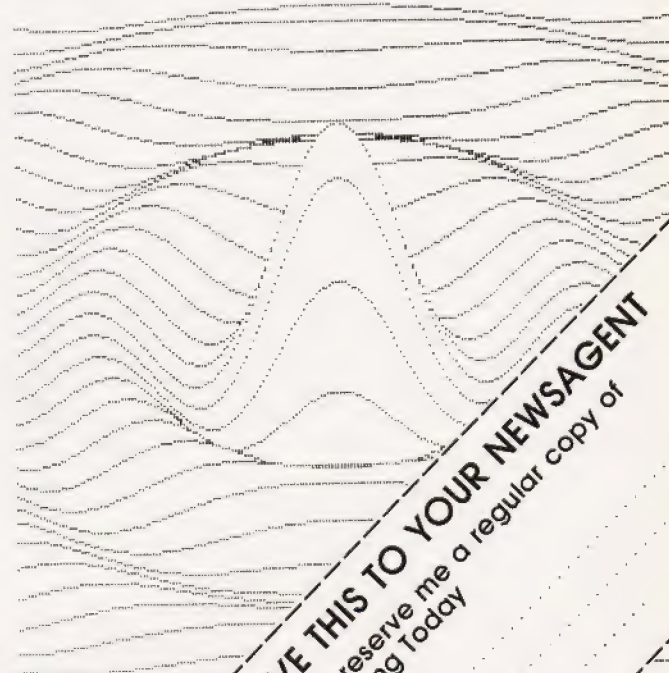
NON-RANDOM RANDOMS

Sounds like a contradiction in terms, doesn't it? But when you're writing a games program that relies heavily on random numbers to control the program operation, it can be very tricky trying to debug the thing. After all, if the program is doing something different every time you run it, how do you check your corrections are having the desired effect? What is needed is a sequence of random numbers that remains the same every time the program runs, which can be

replaced by a true RND function once debugging is complete. However, that usually means large arrays of numbers to store the sequence, or other cumbersome or memory-consuming techniques. Yet it's possible to generate random sequences that are the same every run, with no memory overhead and on any computer. You have until the next issue of Computing Today to figure out how it's done.

EPSON PRINTER GRAPHICS

You've probably seen them — those three-dimensional printouts that look like ripples in water or complex terrain. If you own an Epson printer and you've ever wanted to do the same thing yourself, we'll be showing you how in the next issue of Computing Today. We'll be giving several listings and a lot of examples showing how to brighten up dull mathematical functions.



GIVE THIS TO YOUR NEWSAGENT
Please reserve me a regular copy of
Computing Today

NAME _____
ADDRESS _____
POSTCODE _____

Articles described here are in an advanced state of preparation but circumstances may dictate changes to the final contents.

Garry Marshall

BOOK PAGE

This month we look ahead to some of the exciting developments that lie in the future of computing.

This month's book review pages are devoted to only two books, but as they are both about matters of some importance to the future development of computing in general and, in at least one case, to microcomputing in particular, they do deserve extended examination. One of the books deals with a language that is intended to make the full potential of personal computers readily available to all their users. The other is about the way that it is planned to make the next generation of computers more friendly and also capable of doing more of the things that we want them to. If the books are more about computing tomorrow than computing today, we all know that, with computing, tomorrow can come more quickly than we expect.

SMALLTALK

The Xerox Palo Alto Research Centre (PARC) is where the mouse was devised, and it is also where Smalltalk comes from. The Learning Research Group, now renamed the Software Concepts Group, and in particular one of its members, Alan Kay, conceived the idea of the 'Dynabook'. This is a personal computer about the size of a large notebook that should handle practically all of one's information-related needs. It was conceived as a hand-held high-performance computer with a high-resolution display and input and output capabilities. These should allow it to support visual and audio communication and connect to communication networks to access shared information resources. The intention was for the Dynabook to be available as a personal possession in the 1980s.

Smalltalk is the software component of the Dynabook project. It is designed to allow the owners of the Dynabook to use it creatively by providing a programming environment that allows programmers to create what they need. A programmer can modify Smalltalk by building his own version of the language, either as the only part of the language that he wants to use, or by extending it in a specialised way that meets his needs.

Conventional languages were found to have severe shortcomings in meeting the needs of the Dynabook. One aspect of their shortcomings lies in their separation of data (the items that programs deal with) and procedures (for manipulating the data). This is apparent in languages such as BASIC and Pascal, as is the serial mode of operation that they impose because their program statements are followed in a strictly sequential manner. By contrast, Smalltalk is based on the idea of the 'object'. An 'object' is a package of information describing an item not only by giving the data needed to describe it but also giving

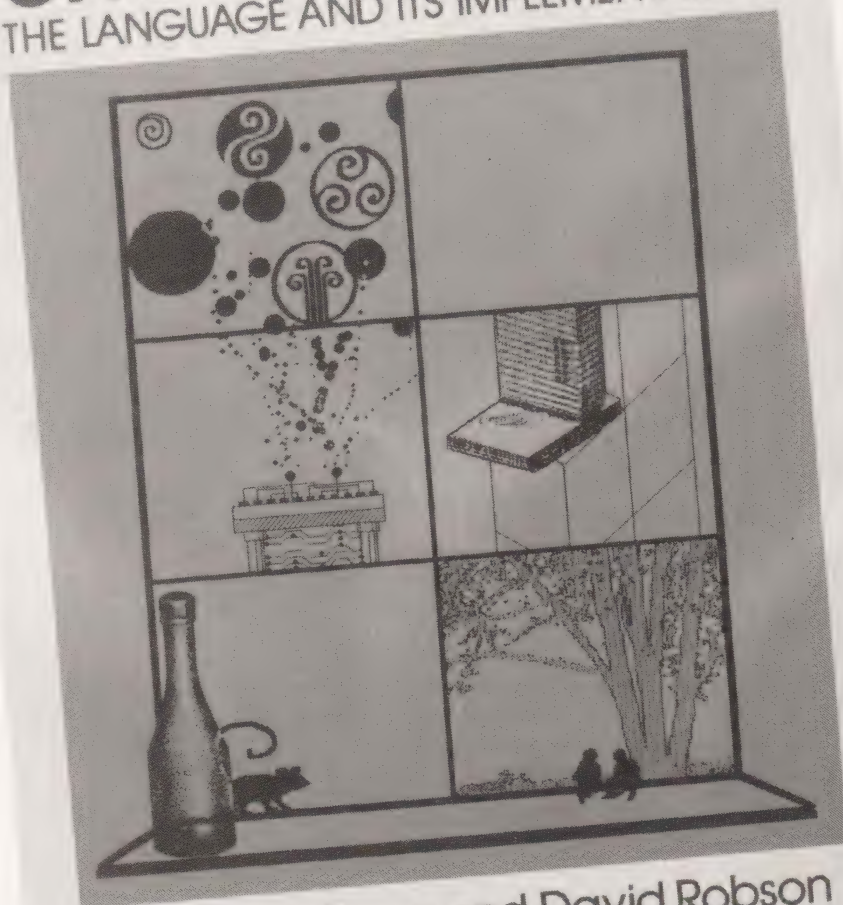
the procedures that determine how the item may be manipulated. Thus, an 'object' consists of data and procedures, all in a single entity. An object is manipulated by sending it a message to carry out one of its procedures to manipulate itself.

To illustrate this, if we have an object for plotting a coloured square on the display screen and moving it around, then it could be named SQUARE, have properties with the self-explanatory names POSITION, SIZE, COLOUR and ORIENTATION, and procedures for manipulating itself called MOVE, ROTATE, ERASE and MAGNIFY. Sending the message SQUARE ROTATE 45 might be expected to cause the object named SQUARE to rotate through 45 degrees, while the message SQUARE ERASE might cause the same object to erase itself from the screen.

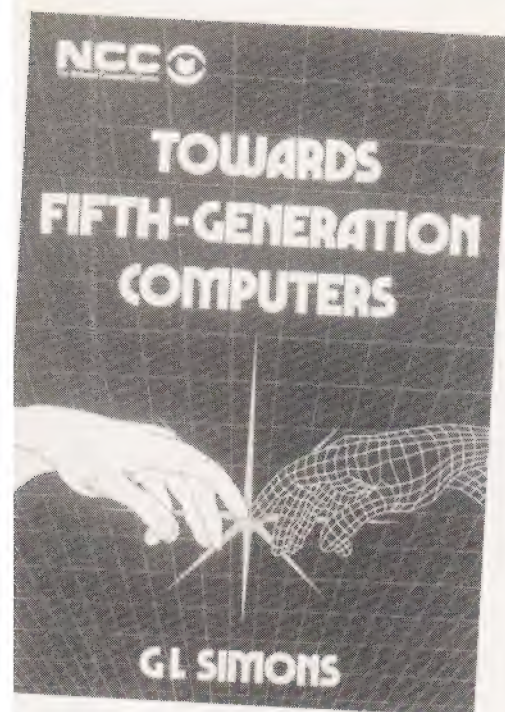
One aspect of the object-message approach is that activities can take place in parallel, as they do in real life, because different parts of the computer can manage the activities of different objects at the same time.

SMALLTALK-80

THE LANGUAGE AND ITS IMPLEMENTATION



Adele Goldberg and David Robson



overall design. In this way the next generation should to some extent conform to a definite plan that takes account of what we need of it rather than consisting of barely considered products whose fabrication is determined by a rapidly evolving technology. **Towards Fifth Generation Computers** aims to explain the main trends and developments that will contribute to the fifth generation of computers.

Although work is being carried out already in most of the areas that fifth generation computers will draw on, the book is inevitably about the future (as its title clearly indicates). The fifth generation computer is a target to aim for rather than a reality. A major consideration in developing it is to ensure that it is suitable for people to use, particularly people with no knowledge whatever of computers. The introduction of menus, icons and mice has already made computers much easier to use than before, while developments such as speech input and output will take the process further. The book's cover captures absolutely the idea of man creating computers in his own image.

However, after its very suitable title and imaginative cover, the contents of the book are a disappointment. It is a 'vacuum cleaner' of a book in that a large number of threads from different sources have been sucked into it, but they have not been integrated or digested. In a chapter on the feature that fifth generation computers should have there is coverage of circuit design, memories, architectures, software languages and knowledge information processing. Material on each topic is presented at a high level, drawn from recent conference, research reports and journals. It can be difficult to understand when lifted too brutally from its full context or when it is too loaded with jargon.

The jargon is a particularly severe problem, since each topic has its own and we are moving fairly quickly from one topic to another. However, a good deal of information on each topic is presented and the sources are listed in an appendix. What is lacking is any indication of how the different topics may interact with each other. There is no indication, for example, of how knowledge will be processed by using particular software, much less of how the designs of hardware and software will affect each other. Thus, no feel is obtained for fifth generation computers as *systems*. They appear as collections of parts that may or may not connect with each other.

Chapters on artificial intelligence, expert systems and man-

machine communications from the heart of the book, perhaps tipping its balance too heavily towards the software side. Again, no relationships between the different topics are presented, but up-to-date explanations are given in each chapter.

The penultimate chapter on 'The Response of Fifth Generation' finds the author in much better form and apparently much surer of himself. It gives a very readable account of the politics, on the Japanese side, of the introduction of the concept and, in the US, UK and Europe, of responding to it. The Americans, by this account, are not unduly put out by the Japanese initiative, holding a pretty low opinion of their ability for innovation of any kind, let alone that required in this case. The British response is contained in the Alvey report, which recommends that research and development should take place in the four key areas of software engineering, the man/machine interface, intelligent knowledge-based systems and VLSI. The government's response to the report is beginning to become apparent, one aspect being its Information Technology initiative as part of which new courses and new lecturing posts in Information Technology have been established in universities and polytechnics.

The final chapter gives us a glimpse of the sixth generation, with biochips that may be able to rearrange themselves and can be arranged in three dimensions rather than the two dimensions of current chip technologies. The use of biochips for computers is obvious (once you have thought of it!), for computers, in the form of brains, have been generated biologically for a long time.

As the book makes clear, the significance of the fifth generation concept probably lies more in providing a clear strategy for developing the next computers than in providing precise blueprints for actual computers. Some aspects of the fifth generation are probably with us now, and when it can be recognised as such it may well contain what now seems to be sixth generation technology.

This month's books are:

Smalltalk 80: The Language and its Implementation by A. Goldberg and D. Robson (Addison - Wesley), 714 pages, £24.95.

Towards Fifth Generation Computers by G. L. Simons (NCC Wiley), 226 pages, £10.50.

Smalltalk-80: The Language and its Implementation is written by two members of the Software Concepts Group at PARC. It describes and explains virtually everything that one might want to know about Smalltalk, but it undoubtedly comes in at rather a high level. Smalltalk is constantly evolving, but the coverage is complete as at the time the book was written. The four parts of the book give an overview of the underlying ideas of Smalltalk and of its specification, an extended example written in Smalltalk, and a full account of how Smalltalk is implemented.

A less demanding introduction to Smalltalk, in case you are interested or feel the need of it, is provided by the articles in the August 1981 issue of *Byte*, which was entirely devoted to Smalltalk, and by an article by Alan Kay in the classic September 1977 issue of *Scientific American* devoted to microelectronics.

FIFTH GENERATION COMPUTERS

The evolution of computers to the present is usually seen in terms of the technology used for their hardware. Broadly speaking, computers of the first generation were constructed using valves, the second generation used individual transistors, the third generation makes use of integrated circuits and the fourth generation uses large scale integration (LSI) circuits. Now, for the first time, there is a concerted attempt to design the next generation of computers. It takes into account both their hardware and software in trying to arrive at a coherent

AGF PROGRAMMABLE JOYSTICK INTERFACE for Spectrum or ZX81

ONLY
32.95
+£10.00 p.p.

ABOUT OUR INTERFACE

The AGF Programmable Joystick Interface is a unique design offering the use of any Atari-compatible joystick with absolutely all software, whether it is cassette or ROM cartridge, with the Sinclair Spectrum or ZX81.

The hardware programmable interface requires no additional software and accurately replicates the keys of the computer in a manner which is responsive to absolutely ALL key reading methods, both BASIC and Machine Code.

The interface does not interfere with key operation and can therefore be used simultaneously with the keyboard.

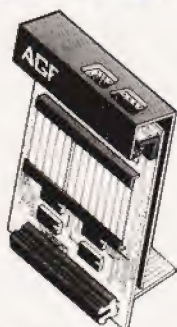
There is no need to remove the interface once fitted as the rear extension connector will accommodate further expansion, i.e. printers or RAM packs etc. The important feature avoids excessive wear to the expansion port.

The key replication principle pioneered by AGF means that your own programs can use eight directional joystick movement by utilising simple key reading BASIC.

Two joystick sockets are provided which share the same keys, for use with the majority of two player games. Several interfaces may be used on the same computer for multiple joystick applications.

The interface is programmed by a two-digit code, which is looked up on a programming chart supplied, for each direction and firing button. The two numbers are then selected on a pair of tracks which are clipped onto appropriately numbered strips on the interface.

Once configured this can be marked on a Quick Reference Programming Card for storing with the game. As the programming is not power dependent the interface retains the last configuration made and can be immediately used when next switched on.



KEY FEATURES

- Programmable design gives TOTAL software support.
- Accepts Atari Competition Pro, Wico, Starfighter, Quick Shot, Jet Stick etc.
- Rear extension connector for all other add-ons.
- Free demo program and instructions.

PACKAGE CONTENTS SUPPLIED

- Programmable Interface Module as illustrated, complete with clip-on programming leads.
- Self adhesive programming chart detailing how to define which key simulates UP, DOWN, LEFT, RIGHT, FIRE, etc. This can be fixed up to the case of your computer or if preferred the protective backing can be left on. The chart is made of a very durable reverse printed plastic and is extremely easy to read.
- One pack of ten Quick Reference Programming Cards for at-a-glance setting to your games requirements. The card allows you to mark the configuration in an easy to read fashion with space to record the software title and company name.
- Video Graffiti demonstration program which is written totally in BASIC to illustrate how all eight directions and fire can be read. This is also a useful high resolution drawing program.
- 12 months guarantee and full written instructions.

JOYSTICKS

CONTROLLERS

FOR USE WITH OUR INTERFACE Module or VIC 20, Commodore 64, Atari VCS, Atari 400, Atari 800

If you require extra Joysticks for our original interface module mark code: 70157 Joystick

ONLY £7.54 inc VAT + P&P

FROM: MR/MRS/MISS			
ADDRESS			
SEND C.W.O. (NO STAMP NEEDED) TO: A.G.F. HARDWARE, DEPT CT,			
FREEPOST, BOGNOR REGIS, WEST SUSSEX, PO22 9BR			
QTY	ITEM	ITEM PRICE	TOTAL
	PROGRAMMABLE INTERFACE	33.95	
	JOYSTICK(S)	7.54	
	PACK(S) QUICK REFERENCE CARDS	1.00	
ONE	VIDEO GRAFFITI	FREE	
ZX81 <input type="checkbox"/> ZX SPECTRUM <input type="checkbox"/> Please tick		FINAL TOTAL	
DEALER ENQUIRIES WELCOME		EXPORT PRICES ON APPLICATION	

...OK. on all issue Spectrums...



Micro Services

HIGH QUALITY CASSETTE DUPLICATION

Confidential and quick service guaranteed.

Most formats handled.

Duplicators for Alligata software. Write or phone for a return price list.

Small or large quantities.

178 West St, Sheffield S1 4ET

Tel (0742) 700969.

24hr ans. service

Credit facilities available inc.



TEXAS TI994A NEW

Adventure No. 1

Hangman

Address Book

Home Accounts

Optical Illusions

all at £4.50 each

including P&P

Buy any 2 and receive
Optical Illusions **FREE**

LINCO DATA

30 BROWN CRESCENT,
SUTTON-IN-ASHFIELD,
NOTTINGHAM NG14 7GY.

Superbase 64

TRANSFORMS THE COMMODORE 64 INTO A FULL-FEATURED AND PROFESSIONAL DATABASE SYSTEM! WITH UP TO 1000 CHARACTERS PER RECORD ON UP TO 4 SCREENS... AND UP TO 128 ITEMS PER RECORD, DEFINABLE AS KEY, TEXT, NUMERIC, CONSTANT, RESULT OR DATE... IN FILES OF UP TO 16M CHARACTERS! SUPERBASE EVEN HAS SPREADSHEET AND CALCULATOR CAPABILITY, CALENDAR FUNCTIONS, EASY INPUT FROM WORDPROCESSOR/DATA FILES, BOTH MENU-DRIVEN AND PROGRAM OPTIONS, SORTING/SEARCHING, FULLY DEFINABLE OUTPUTS... SUPERBASE 64 IS ESSENTIAL IF YOU WANT THE MOST FROM YOUR 64! SUPPLIED ON CBM 1541 DISK WITH EXCELLENT TUTORIAL/REFERENCE MANUAL. EX-STOCK NOW!

● OUR PRICE ONLY ~~199.95~~ £88!

VIZAWRITE 64

NOW AVAILABLE ON CARTRIDGE. VIZAWRITE 64 IS A HIGH-PERFORMANCE, LOW-COST WORD PROCESSOR, WITH ON-SCREEN FORMATTING, THAT TAKES FULL ADVANTAGE OF THE 64'S COLOUR, GRAPHICS AND MEMORY FEATURES... AND SUPPORTS VIRTUALLY ANY PRINTER! WITH A COMPREHENSIVE AND EASY-TO-FOLLOW USER MANUAL, VIZAWRITE OFFERS THE ULTIMATE IN PERSONAL COMPUTER WORD PROCESSING! ALSO AVAILABLE ON DISK (OUR PRICE ~~179.95~~ £65!), OR COMBINED WITH VIZASPELL (OUR PRICE ~~199.95~~ £85!).

● OUR PRICE ONLY ~~179.95~~ £68!

Master 64

MASTER 64 IS A TOTALLY NEW CONCEPT... A COMPLETE PROGRAM DEVELOPMENT PACKAGE, THAT'S AVAILABLE NOW FOR THE CBM 64. MASTER HAS 85 NEW COMMANDS... AND BASIC IV TOO! PLUS PROGRAMMER'S TOOLKIT, MACHINE CODE MONITOR, BUSINESS BASIC, KEYED DISK ACCESS, SCREEN MANAGEMENT, USER-DEFINABLE INPUT ZONES, REPORT GENERATOR, 22-PLACE ARITHMETIC, DATE CONTROL, STRING FUNCTIONS, DISK DATA COMPRESSION, SCREEN PLOTTING, SCREEN DUMP, OPTIONAL SOFTWARE PROTECTION KEY, AND MORE... IN FACT EVERYTHING YOU NEED TO PROGRAM YOUR 64 TO TOP PROFESSIONAL STANDARDS! MASTER 64 COMES WITH A FULL USER REFERENCE MANUAL, QUICK REFERENCE GUIDE AND DEMO PROGRAMS. ALSO AVAILABLE FOR CBM 700 (£339.25) AND CBM 4032/8032/8096 (£339.25 - £225!).

● SPECIAL OFFER PRICE ~~1143.75~~ £115!

THESE ARE JUST SOME OF OUR FINE SOFTWARE PRODUCTS FOR COMMODORE COMPUTERS... PLEASE TELEPHONE OR WRITE FOR FREE DATA SHEETS! PRICES SHOWN INCLUDE 15% VAT AND ARE CORRECT AT TIME OF GOING TO PRESS. ORDER BY POST/TELEPHONE/PRESTEL, USING CHEQUE, ACCESS, BARCLAY CARD OR OFFICIAL ORDER. TELEPHONE 01-546-7236 FOR SAME-DAY DESPATCH! POST FREE EXCEPT ON CREDIT/OVERSEAS ORDERS. (REF A23)

Calco Software

LAKEHOUSE, KINGSTON HILL, SURREY KT2 7OT TEL 01-546-7236



CROWN

PLEASE PHONE 0323 20496/639983

BUSINESS CENTRE LTD

56-58 · SOUTH STREET · EASTBOURNE · BN21 4UZ

The Brother CE50 CEM, Easywheel Typewriter has been introduced to run with most computers. Medium duty use - super print quality - full typewriter function including auto corrector - (0.13 cps per second - 10 million cps) full day/night use. The complete solution to your computer system.



NOT A LIGHT
DUTY MACHINE!
EXPECTS
3 HOURS A DAY USE

BROTHER CE50 PARALLEL/SERIAL INTERFACES

(KSR about 3 weeks)

LAUNCH OFFER £399.00 + VAT



PRINTER BUFFERS

16k £126.00
+ VAT
ex stock

48k £158.00
+ VAT
ex stock

Available in
PS232

Centronics
IEEE

SUPERB VALUE

CROWN RANIER

£795.00

+ VAT

The most printer/typewriter available - 8 lines/continuous use per day - note for full specification - ex stock



BROTHER HRI PRINTER
SERIAL & PARALLEL INTERFACES AVAILABLE

£695.00 + VAT ex stock



BDT SHEET FEEDER

FOR BROTHER HRI
AND BROTHER CROWN RANIER

ONLY **£449.00 + VAT ex stock**



MICROTANIC COMPUTER SYSTEMS LTD.

MICROTAN 65 NO OTHER COMPUTER IS AS PERSONAL!

For less than £60 you can start building your own Computer that truly suits your needs and, of course, eventually far more superior to any Computer available off-the-shelf.

MICROTAN 65 comes in kit form, complete with manual, full instructions, board with components, (kit form or fully built) our full back-up service, and your own Microtan World Magazine available on subscription.

FLEXIBLE & EXPANDABLE SYSTEM — 1K to 256K!

Just look at the options:

- | | |
|----------------------|-------------------------------|
| 1 DISK CONTROLLER | 7 MASS EPROM STORAGE BOARD |
| 2 REAL TIME CLOCK | 8 INDUSTRIAL CONTROLLER BOARD |
| 3 EPROM PROG. CARD | 9 40K RAM BOARD |
| 4 SOUND BOARD | 10 HIGH RES. GRAPHICS 256x256 |
| 5 SERIAL I/O BOARD | 11 PRINTER FACE BOARD |
| 6 PARALLEL I/O BOARD | 12 ASC11 KEYBOARD |

FULL RANGE OF SOFTWARE

Languages available: Machine Code, Assembly, Basic, Fort, and Pilot

HOW TO ORDER:

Enter details in the coupon below, enclosing your cheque made payable to: Microtan Computer Systems Ltd. Prices include VAT add £1.50 p.p. Please allow 14 days for delivery.

Post to:
MICROTANIC COMPUTER SYSTEMS LTD
16 UPLAND RD LONDON SE22
Tel No. 01-693 1137

Please rush me my starter kit:
(Please tick)

- ☐ kit form — I will build myself £58.95
☐ Fully Built £69.95
☐ Complete system wall chart

I enclose my cheque/P.O. for £

Name

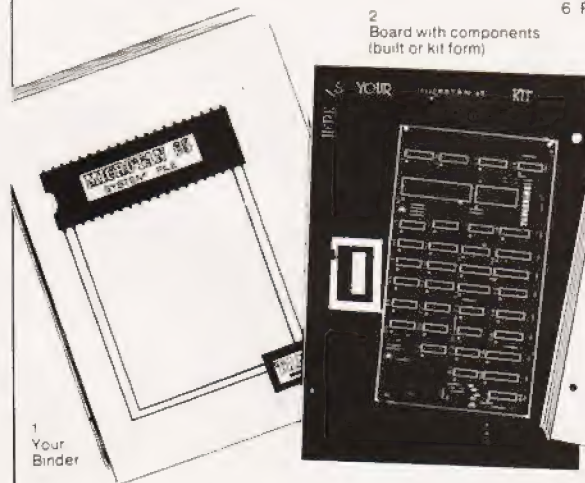
Company

Address

Tel (Day)
Tel (Eve)



Microtan
World Magazine



MICROTAN COMPUTER SYSTEMS LTD

SHOWROOM: 16 UPLAND RD
DULWICH, LONDON SE22
TEL: 01-693-1137

MAIL ORDER:
235 FRIERN RD. DULWICH
LONDON SE22

Also available from:
Waltham Forest Computer Centre
889 Lee Bridge Rd.
Nr Whipps Cross, Walthamstow E7
Tel: 01-520 7747

Tony Cross and Phil Cornes

GETTING MORE FROM THE 64

PART 2

Following our look at sprites on the Commodore 64 last month, we examine the high resolution graphics screen. There are also several useful machine code routines that Commodore forgot to include.

A high resolution graphics screen is now an essential part of any self-respecting micro. The extra resolution means that each screenfull contains more information. Diagrams and graphs can be made more detailed and pictures become more realistic. On the Commodore 64 the 320 by 200 dots high resolution screen is more than adequate for most purposes. However, accessing and using the screen is by no means straightforward

SCREEN ORGANISATION

Let's begin by looking at the way the high resolution screen is organised. The high resolution screen is 'bit mapped' into memory. This means that each dot on the screen is controlled by a bit in memory. If the bit is a 1 then the dot will be lit, if it is a 0 then the dot will not be lit.

Armed with this information we can work out how much memory will be needed to store the high resolution screen. The number of dots on the screen is $320 \times 200 = 64000$. Each byte can control eight dots, so we will need $6400/8 = 8000$ bytes to store the screen. In the 64K of RAM available there are eight different places where the screen could be located ($65535/8000 = 8.192$). However, the VIC chip can only 'see' 16K of RAM at a time and in the standard configuration it is looking at the first 16K. (It is possible to make the VIC chip look at the other 16K banks of memory, but that's beyond the scope of this month's article.)

This means that there are only two possible locations for the screen in the standard configuration. These are at location 0 and at location 8192 decimal. (8192 is used because this is 8K or 2^{13} , which is a much more convenient number to a computer than 8000.)

We mentioned last month that the first 1K bytes of memory are fully used by the Commodore 64 'operating system'. There are also many BASIC pointers and variables stored in other low memory locations. All this means that the high resolution screen cannot be stored at location 0. So, in the standard configuration, the only place where the high resolution screen can be located is at locations 8192 decimal to 16191 decimal.

LOCATING THE HIGH RESOLUTION SCREEN

To find out where the high resolution screen is located, the VIC chip looks at bit 3 of the VIC memory control register, which is at location 53272 decimal. If the bit is a 0 then the screen is at location 0 (within the current 16K 'bank'). If the bit is a 1 then the screen is at location 8192 (within the current 16K 'bank'). For example, to locate the high resolution screen at 8192 decimal, type `POKE 53272, PEEK(53272) OR 8`.

Just as with sprite data, locating the high resolution screen at 8192 takes up BASIC text space, and since BASIC starts at location 2048 it is quite likely that BASIC programs will overwrite the high resolution screen. This can be avoided by using a modified version of the MEMSHIFT routine

presented last month. MEMSHIFT currently moves the bottom of BASIC up to location 2560 decimal to give room for sprite data. By changing a couple of bytes in the routine it can be made to move BASIC up to location 16384 decimal. (This is the closest to location 16191 decimal that you can get, because the bottom of BASIC can only be shifted in multiples of 256 bytes.)

The BASIC program to load this modified version of MEMSHIFT is included at the end of this article. The modified MEMSHIFT is executed in just the same way as the old version, by using the `SYS 49329` command from BASIC.

The net result of moving the bottom of BASIC to location 16384 decimal is that we have 'lost' 14K of BASIC space (although we still have 24K left). On the 'plus' side, however, we have protected the high resolution screen and we have enough room between locations 2048 decimal and 4095 decimal for 32 sprites. (Remember from last month's article that sprites cannot be stored between locations 4096 decimal and 8191 decimal.)

USING THE HIGH RESOLUTION SCREEN

Having located the high resolution screen in memory we can now enter high resolution mode. This is done by setting bit 5 of the VIC control register, which is at location 53265 decimal. For example, to enter high resolution mode, use `POKE 53265, PEEK(53265) OR 32`.

The VIC chip will now start displaying the contents of the high resolution screen. Initially the screen is full of garbage and this comes from two sources. First, the contents of memory locations 8192 to 16191 are probably full of rubbish and this will be displayed as red dots on a black background. In addition, any text characters that were being displayed on the normal text screen are now displayed as different coloured squares on the high resolution



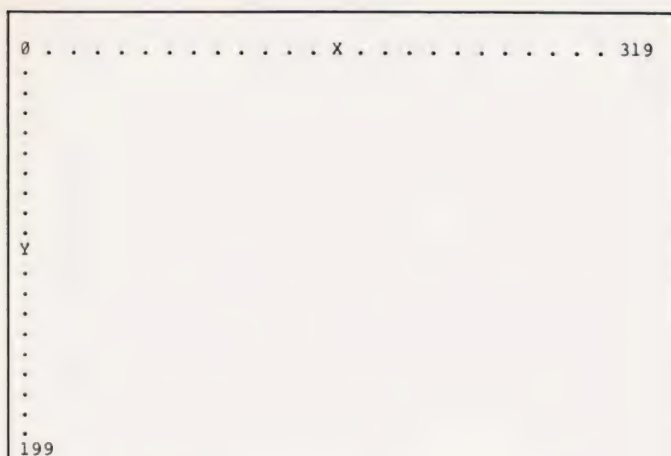


Fig. 1 The logical layout of the high resolution screen.

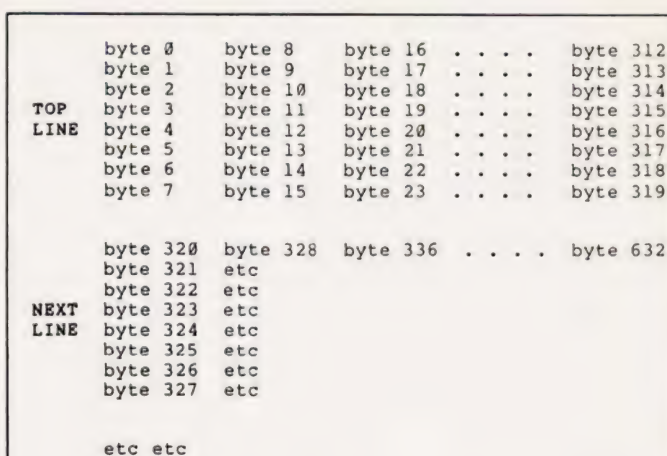


Fig. 2 The physical organisation of the high-res screen.

screen. This happens because the normal text screen is used to store the high resolution colour information (more on this later).

The first thing to be done, then, is to clear the high resolution screen. The coloured squares can be removed by printing a 'clear screen' character (Shift/Clr), although they will reappear if you type anything on the keyboard. Clearing the high resolution screen memory can be done from BASIC as follows:

```
100 FOR I=0 TO 7999: POKE
  8192+I,0: NEXT I
```

Since this is a very slow process (it takes about 15 seconds to clear the screen), we have also included a machine code clear screen routine. The routine is called CLEAR and it is called by a SYS 49378 command from BASIC. After executing CLEAR, all memory locations from 8192 to 16191 will be set to zero.

PLOTTING POINTS ON THE SCREEN

Just before we actually start drawing on the high resolution screen we need to look at the way in which the screen is laid out. There are two ways of visualising the layout of the high resolution screen. These are:

- The logical view, which is the way you would like the screen to be organised, as shown in Fig. 1.
- The physical view, which is the way the screen is really organised, as shown in Fig. 2.

Obviously the logical view is the one we want to be using when we refer to screen locations, so a conversion formula to convert from the logical to the physical view is needed. There isn't enough space to be able to describe how the formula is arrived at, but here it is anyway. (Assume that the x and y

coordinates are given by X and Y respectively.) The byte which must be changed is given by:

```
BYTE = 8192 + INT(Y/8)*320 +
  INT(X/8)*8 + (Y AND 7)
```

The bit within that byte which must be set is given by:

```
POKE BYTE, PEEK(BYTE) OR
  2*(7 - (X AND 7))
```

In BASIC this tends to be fairly slow, particularly if you use it as part of a line draw routine. To overcome this problem we have included another machine code routine which does the conversion and lights the appropriate dot for you.

The routine uses the value in the integer variable X% as the x coordinate and the value in the integer variable Y% as the y coordinate. There are two 'entry points' to this routine: one called PLOT, which turns on the dot at X%, Y%, and one called UNPLOT which turns off the dot at X%, Y%.

To use the routine, first set up X% and Y% to contain the desired coordinate, then use the SYS 49475 command for the PLOT entry point and the SYS 49488 command for the UNPLOT entry point. No range checking is done on either of the two coordinates although the Y coordinate is always treated as a one byte number, which means that it can never be greater than 255. If either X% or Y% does not exist then a SYNTAX ERROR message will be returned.

USING COLOUR

As we mentioned earlier, the colour information for the high resolution screen comes from the normal text screen at locations 1024 decimal to 2023 decimal. Each text screen location holds the colour for a square eight dots wide

by eight dots high on the high resolution screen. Location 1024 controls the colour for screen bytes 0 to 7, location 1025 controls the colour for screen bytes 8 to 15 and so on (see Fig. 2).

Like sprites, the high resolution screen can operate in two colour modes. These are:

- Standard colour mode where each dot on the screen can be one of two colours.
- Extended colour mode where each dot can be in one of four colours.

In 'standard colour' mode the high four bits of the appropriate text screen location hold the colour for a dot which is lit (1), while the low four bits of the text screen location hold the colour for a dot which is not lit (0). Usually the whole screen will be using the same two colours which means that the appropriate composite colour value must be written into the whole text screen. (This is why the screen was initially red dots on a black background. A 'cleared' text screen is really full of 'space characters which are code 32 decimal. This translates to a red foreground and a black background!)

You can fill the screen with any combination of foreground and background colours by using the following line of code where the variable C contains the composite colour:

```
110 FOR I=1 TO 999: POKE 1024+I,C:
  NEXT I
```

Like the BASIC clear screen routine this process is also fairly slow. In addition, sorting out the composite colour value can be a bit awkward. To overcome these problems we have included another machine code routine (last one this month - honest!) to set up the colours for you.

The routine is called COLOUR ►

DOT PAIR	DOT COLOUR
00	Background colour register 0
01	High four bits of the text screen memory
10	Low four bits of the text screen memory
11	Normal colour memory

Fig. 3 Dot pair coding for the extended colour mode.

and it reads the values in the BASIC integer variables FC% and BC% to get the foreground and background colours respectively. To use COLOUR, first set up FC% and BC% and then call COLOUR with the SYS 49401 command from BASIC. The whole of the text screen memory will then be filled with the appropriate composite colour value.

No range checking is done on either of the colours but only the low four bits of each value is 'read' which limits their range to 0-15. If a SYNTAX ERROR message is returned by COLOUR then either FC% or BC% did not exist.

In 'extended colour' mode you sacrifice horizontal resolution for increased colours. Instead of every dot being in one of two colours, the horizontal dots are now 'read' in pairs so that each pair of dots

can be in one of four colours.

Figure 3 shows how the dot pairs are coded into colours.

The background colour register 0 is located at 53281 decimal and it normally holds the text screen background colour. The colour value in this register is the same for the whole high resolution screen.

The normal colour memory runs from 55296 decimal to 56295 decimal. As with the text screen memory, each colour memory location controls the colour for an eight-by-eight square.

To select extended colour mode for the high resolution screen you must set bit 4 of the second VIC control register at location 53270 decimal. For example, to select extended colour mode POKE 53270, PEEK(53270) OR 16.

DRAWING SHAPES ON THE SCREEN

Unfortunately there isn't space this month to look at line and circle drawing routines. We hope to produce another article on this subject at a later date. In any case, lines and circles can be drawn by repeated calls to the PLOT routine with some other control routine, in BASIC or machine code, to set up the X% and Y% coordinates.

THE MACHINE CODE ROUTINES

Finally for this month, here is the BASIC program to load the modified version of MEMSHIFT and the CLEAR, COLOUR, PLOT and UNPLOT routines. Before loading these routines you must first load the set we presented last month. This is because this month's routines call several subroutines which were in last month's listing.

That's all for this month — next month we will look at the sound and music facilities on the Commodore 64.

```

10 REM Routine to load MEMSHIFT, CLEAR, COLOUR, PLOT & UNPLOT
20 FOR A=0 TO 273
30 READ Q : POKE 49329+A,Q
40 NEXT A
100 DATA 162,64,160,0,24,32,156
110 DATA 255,200,132,43,134,44,169,0
120 DATA 141,0,64,76,66,166,165,168
130 DATA 197,170,208,7,165,167,197,169
140 DATA 208,1,96,160,0,165,171,145
150 DATA 167,230,167,208,233,230,168,76
160 DATA 198,192,169,0,133,167,169,32
170 DATA 133,168,169,64,133,169,169,63
180 DATA 133,170,169,0,133,171,76,198
190 DATA 192,169,195,133,251,169,194,133
200 DATA 252,32,0,192,176,46,152,41
210 DATA 15,133,171,169,195,133,251,169
220 DATA 198,133,252,32,0,192,176,28
230 DATA 152,10,10,10,10,5,171,133
240 DATA 171,169,4,133,168,169,0,133
250 DATA 167,169,7,133,170,169,232,133
260 DATA 169,76,198,192,169,27,141,17
270 DATA 208,169,21,141,24,208,162,11
280 DATA 108,0,3,32,95,193,32,128
290 DATA 193,160,0,17,180,145,180,96
300 DATA 32,95,193,32,128,193,160,0
310 DATA 73,255,49,180,145,180,96,169
320 DATA 216,133,252,169,128,133,251,32
330 DATA 0,192,176,200,134,181,132,180
340 DATA 169,217,133,252,169,128,133,251
350 DATA 32,0,192,176,183,132,182,96
360 DATA 165,180,72,41,7,133,183,104
370 DATA 41,248,133,180,165,182,72,41
380 DATA 7,133,184,104,41,248,72,74
390 DATA 74,74,133,182,74,74,24,101
400 DATA 182,133,182,104,10,10,10,5
410 DATA 184,24,101,180,133,180,165,182
420 DATA 101,181,24,105,32,133,181,169
430 DATA 128,166,183,232,202,240,3,74
440 DATA 16,250,96

```

Listing 1. Routine to load MEMSHIFT, CLEAR, COLOUR, PLOT and UNPLOT.

PLAY ALL DAY WITH THE LATEST AND GREATEST SOFTWARE TO BE SEEN ON SCREEN!

PLAY ALL DAY!! JANUARY 6th 7th 8th



January 6th 7th 8th are the dates when you can play all day with the very latest in software on the very best computers, including Atari, Vic 20 and 64, ZX plus Spectrum, Oric, Dragon and BBC A & B. All will be on display at **The London Home Computer Show!**

Once again the emphasis will be on the lower end of the price bracket, with computers from £50 up to £300.

Play all day, try or buy it's all there at the greatest home computer show on earth!

Friday 6th January 1984 -

10.00 a.m. - 6.00 p.m.

Saturday 7th January 1984 -

10.00 a.m. - 6.00 p.m.

Sunday 8th January 1984 -

10.00 a.m. - 4.00 p.m.



The London Home Computer Show,
Royal Horticultural Society's New Hall,
Greycoat Street,
London S.W.1.

Admission Adults £2.50
Children under 16 £1.50

THE LONDON HOME COMPUTER SHOW

THE NEW MPF1 PLUS...



...THE LOWEST COST
Z80 SINGLE BOARD COMPUTER
AVAILABLE WITH ALL THESE FEATURES!

BUILT-IN
ASSEMBLER

The MPF1 PLUS incorporates the Z80 – the most widely used 8-bit microprocessor in the world, to form a Single Board Computer (SBC). Packed in a plastic bookcase together with three comprehensive manuals and power supply (to BS3651 standard), the MPF1 PLUS is a microprocessor learning tool for every application.

FLIGHT
Electronics Ltd.

Quayside Rd, Southampton, Hants SO2 4AD. Telex 477793. Tel. (0703) 34003/27721.

Micro-Professor is a trade mark of Multitech Industrial Corporation. Z80 is a trade mark of Zilog Inc.

Teaching you in a step-by-step method the MPF1 PLUS helps the user fully understand the Software and Hardware of a microprocessor easily and conveniently – as opposed to micro-computers that aim to teach high-level languages instead of microprocessor systems fundamentals.

Not only is the MPF1 PLUS a teaching tool but with the available accessories it can also be used as a low-cost development tool or simply for OEMs.

THE MPF1 PLUS

Just look at the specification:-

Technical Specification

CPU: Z80A – 158 instructions

Software:

- Z80/8080/8085 machine code
- Z80 Assembler, line and 2 pass.
- 8K BASIC interpreter (Extra)
- 8K FORTH (Extra)

ROM: 8K Monitor (full listing and comments)

RAM: 4K CMOS (2 x 6116)

Input/Output: 48 system I/O lines

Speaker: 2.25" coned linear

Display: 20 character 14 segment green phosphorescent

Expansion:

- Socket for 8K ROM
- Cassette interface
- Connectors 40 way, complete CPU bus

Keyboard: 49 key. Full "QWERTY" real movement good tactile feedback

Batteries: 4 x U11 for memory back-up (batteries not included)

Serial Interface: 165 baud for read/write via audio cassette

Manuals

1. User's Manual. 8 chapters.
 1. Over view and Installation.
 2. Specification (hardware and software).
 3. Description of Operation.
 4. Operating the MPF-1 Plus.
 5. 44 Useful Sub-Routines.
 6. The Text Editor.
 7. Assembler and Disassembler.
 8. System Hardware Configuration.
2. Experiment Manual. 16 experiments.
3. Monitor Program Source Listing with full commenting.
4. Also available the MPF-1 Plus Student Work Book (self-learning text).

Accessories

- **PRT-MPF-1P:** 20 character printer. Ready to plug in. Memory dump.
- **EPB-MPF-1P:** Copy/list/verify 1K/2K/4K/8K ROMs. Ready to plug in.
- **SSB-MPF-1P:** Speech Synthesizer. Inc. 20 words and clock program. 1200 words available.
- **SGB-MPF-1P:** Sound Synthesizer Board.
- **I/O – MPF-1P:** Input/output board

Yes! I now realise that I need an MPF1 PLUS and that it is the lowest cost Z80 SBC available with all these features.

I enclose £165.00 (£140.00 + £21 VAT plus £4 carriage). Overseas P.O.A.

Cheques payable to
FLIGHT ELECTRONICS LTD.

Please debit my
Barclaycard/Access



Account No.

An invoice will automatically be sent

Name

Address

Signature

Date

ETI



ORIC AND SINCLAIR COMPUTERS

Oric 1 computer 48K £143 (£141) £151
 £122 Oric colour printer £134 (£123)
 £140 Sinclair Spectrum 48K £131
 (£131) £143 Spectrum 16K £101 (£105)
 £117 32K memory upgrade kit for
 16K Spectrum (issue 2 only) £31 (£28)
 £30 ZX printer with 5 free rolls paper
 £41 ZX printer alone £36 (£38) £50 5
 printer rolls £13 (£16) £21 ZX81 £37
 (£37) £47 Special offer pack ZX81
 computer + 16K ram pack + game tape
 £49 (£55) £65 ZX81 16K ram packs £31
 (£28) £30

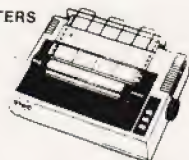
COMMODORE COMPUTERS

Commodore 64 £204 (£184) £204 Vic
 20 £104 (£97) £117 Converter to allow
 most ordinary mono cassette
 recorders to be used with the Vic 20
 and Commodore 64 - built £9.78 (£9)
 £11 kit £7.47 (£7) £9 Commodore
 cassette recorder £43 (£44) £50 1541
 Disc drive £235 (£209) £234 1525
 Printer £235 (£220) £245 1526 Printer
 £350 (£330) £360

ACORN COMPUTERS

Electron £203 (£209) £229 BBC Model
 B £404 (£368) £388 Kenda double
 density disk interface system for beeb
 £139 (£125) £135 We stock the whole
 range of Cumana disc drives for the
 beeb e.g. 100K single £230 (£220) £240
 Double 2 x 400K £625 (£560) £580

PRINTERS



Epson RX80 £326 (£309) £340 Epson
 RX80F/T £346 (£316) £346 Shinwa CT1
 CP80 £293 (£271) £312 Epson FX80
 £440 (£408) £483 Epson MX100/3 £494
 (£465) £495 Seikosha GP100A £234
 (£219) £254 Oki Microline 80 £243
 (£227) £268 Oki Microline 84 £831 The
 Ultra 21 combined daisy wheel and
 electric typewriter £438 (£415) £445
 The brother EP22 combined matrix
 printer and electric typewriter £173
 (£166) £186 Juki 6100 proportional
 daisy wheel printer £423 (£404) £434
 MCP40 colour printer £134 (£123)
 £140 Star STX80 thermal printer £165
 (£159) £169 We can supply interfaces
 to run all the above from Sharp
 computers £58 (£52) £55

VIDEO GENIE, UK101 AND SUPERBOARD

We still support these gorgeous
 machines. Write for our tempting list of
 add ons

SWANLEY ELECTRONICS

Dept. CT, 32 Goldsel Road, Swanley, Kent BR18 8EZ, England.
 TEL: Swanley (0322) 64851

Nothing extra to pay. All prices are inclusive. UK prices are
 shown first and include post and VAT. The second price in
 brackets is for export customers in Europe and includes
 insured air mail postage. The third price is for export
 customers outside Europe (include Australia etc) and
 includes insured airmail postage. Official orders welcome.

SPRAKEFIELD LTD

137 HIGH STREET SOUTH
 DUNSTABLE, BEDS. Tel: (0582) 608818



ALL PRICES INCLUDE VAT & CARRIAGE

PRICES DOWN ON SOFTWARE & PRINTERS

FLOPPY DISKS — BOXES OF 10

VERBATIM 5 1/4"	1-3	4-7	8+
MD525 SSDD	19.78	19.26	18.78
MD550 DSDD	28.12	27.38	26.69
MD577 SSDD	30.53	29.75	28.98
MD557 DSDD	36.92	35.96	35.05

DYSAN 5 1/4"			
104 1 SSDD	28.13	27.70	27.29
104 1D SSDD	30.43	29.96	29.52
104 2D DSDD	43.34	42.68	42.05
204 1D SSDD	42.28	41.64	41.02
204 2D DSDD	56.08	55.23	54.40

LIBRARY CASE 1 69 EXTRA

FREE FLOPPY DISK PEN WITH EVERY
 BOX

SOFTWARE

dbase II	£442.75
Lotus 1-2-3	£341.55
VisiCalc	£183.97
WordStar	£284.63
Mailmerge	£143.75
Spellstar	£143.75
Perfect Writer	£189.75
Perfect Calc	£112.21
Perfect Files	£228.08
Basic Compiler	£272.55
Pascal Compiler	£241.50
C Compiler	£345.00

(Apple, Commodore, IBM, DEC, CP/M)

MONITORS

Hi-Res 12" Monitor
 Green £117.46
 Amber £124.86

Colour 14" 800-dot RGB
 for IBM PC
 £671.93

PRINTERS

Epson RX80	£309.73	Seikosha GP100A	£230.00
Epson FX80	£462.00	Smith Corona TPI	£483.00
Epson MX100	£497.00	Ricoh RP1600	£1648.33
Oki M80A	£251.47	Ricoh RP1300	£1311.00
Oki M82A	£371.07	Flowriter	£1748.00

Kuma

- a unique pool of expertise

EPSON

SHARP



HARDWARE PLUS

HARDWARE PLUS

Software from the home
 of the Deskmaster series — the major
 source for HX-20 Software

A wealth of Software
 from the originators
 of Sharp approved Software for
 the MZ700 — also MZ80A,
 MZ3541 and PC1500

commodore 64

SAGE

HARDWARE PLUS Accounts, Database and Toolkit Software

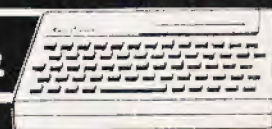


HARDWARE PLUS



68,000 based Forth.

NewBrain



HARDWARE PLUS Pascal, Forth and much, much more



SINUS 1

HARDWARE PLUS Kuma Forth, Mailbox and much more



PHONE NOW
 MAIDENHEAD
 (0628) 71778

or SEND FOR
 DETAILS

ELECTRONIC MAIL BOX

Software, advice, modems and acoustic
 couplers from experienced users

PRINTERS



A great range of Matrix and Daisywheel.

Kuma Computers Ltd

11, York Road,
 Maidenhead, Berks SL6 1SQ

COMET: KUMA

Telex 849462 TELFAC KUMA

TELECOM GOLD: KUM 881

Please tick box ☒ for information required, and send coupon to
 Kuma Computers, Ltd, 11 York Road, Maidenhead, Berks SL6 1SQ

Hardware	Software	Hardware	Software
<input type="checkbox"/> SIRIUS	<input type="checkbox"/>	<input type="checkbox"/> EPSON HX-20	<input type="checkbox"/>
<input type="checkbox"/> SAGE	<input type="checkbox"/>	<input type="checkbox"/> EPSON QX-10	<input type="checkbox"/>
<input type="checkbox"/> SHARP 700	<input type="checkbox"/>	<input type="checkbox"/> NEWBRAIN	<input type="checkbox"/>
<input type="checkbox"/> SHARP A	<input type="checkbox"/>	<input type="checkbox"/> COMMODORE 64	<input type="checkbox"/>
<input type="checkbox"/> SHARP 3541	<input type="checkbox"/>	<input type="checkbox"/> ELECTRONIC MAILBOX	<input type="checkbox"/>
<input type="checkbox"/> SHARP PC1500	<input type="checkbox"/>	<input type="checkbox"/> PRINTERS	<input type="checkbox"/>

NAME

ADDRESS

POST CODE

Peter Hewitt

THE PROGRAMMER'S AID

Single key entry of BASIC keywords is made possible on the TRS-80 by this simple program. You also get keyboard entry of graphics characters, and a free giveaway program to test the routine.



A thing I personally find offensive about keying in a BASIC program is that after having taken the trouble to type in, for example, the six characters of the keyword 'RETURN', the computer has the audacity to convert it into a single character (146) before storing it!! It's enough to make you think that the ZX81 has it right!!!

So you can go out and buy a package which gives you a single-keystroke entry facility. This allows

you, by hitting a shifted key, to produce one of 26 standard keywords, which are preset for the particular package. The trouble is that it's a safe bet that a keyword you particularly need is missing, and there is very little that you can do about it.

The TRS-80 interpreter has the capacity to convert 123 keywords into 'tokens', in the range 128 to 251. These are shown in the table, together with their start locations in memory, given by the first value

times 256 plus the second.

The first program, The Programmer's Aid, pokes into high memory a machine-code routine which allows the user to get into this section of memory and pull out the whole individual keyword with a single keystroke. This is achieved by hitting any of the shifted 'alpha' characters. For example, shifted 'R' (see line 110) accesses the location given by the pair 23/157 — the keyword 'AND'. By altering the values in this line, it can be made to produce AUTO (23/60), ABS (23/171), ATN (23/204), ASC (24/10) or anything else. It depends very much on the sort of program you are developing or copying.

Key the program in carefully, but please save it before attempting to RUN it! When you are satisfied that all is well then RUN it. It will return to READY. Now hit any shifted letter, and you will see that the full keyword appears instantaneously. If you think that you would have preferred to have had a different keyword from that key, then you will find that the reference pairs are stored between locations 32703 and 32754. You can do a little PEEKing and POKEing to make any necessary corrections. DO NOT attempt to amend the program and re-RUN it. This will lock the whole system up, since it won't know what it has done with its 'Keyboard Driver'. If you have suffered from the same thing, you will know how painful *that* is! If you want to start again, you must switch off, then re-load the program from tape (or disc of course). To be entirely safe, you should remember to enter NEW immediately after running the program. Note that the program has two lines numbered 50. You will only need one of them, depending on your operating system: simply omit the other. If you are using DOS, then be warned that you will have as little as 5.3K of memory left, and you may have to look into re-locating the program, which is not straightforward.

GRAPHICS TOO

Got it de-bugged and working? OK, now hit Shift and Right-arrow: gosh, a flashing cursor! Now type in a few characters, and you will get what appears to be garbage. Well, have faith. What you are getting is the graphic character corresponding to the ASCII value of the key you hit, plus 100. Thus key 'P' produces character 180. There are five exceptions, and these are shown at the end of the

program listing. To return to 'normal' operation, simply hit Shift and Right-arrow again. The cursor becomes static again, confirming that your message has been received and understood.

There is little terribly significant about the program itself. Note that it sets its own memory limit in line 30, thus saving you the chore. This is preset to 32552, which means that the first few bytes of the routine are available for overwriting, since they are redundant after the keyboard driver has been relocated.

WINDOW DRESSING

In the hope of demonstrating the use of this new tool, the second program listing is of a fairly well-known game, which I have chosen to call 'Window'. The idea is simple enough: a 'ball' is dispatched towards a window, and half-way there, suddenly disappears. You have got to hit the space bar to stop it before it hits the window, and the closer to the pane, the higher the score — up to 20 for a 'toucher'. Simple enough, but the graphics for the window breaking are a little bit fussy, or would be if the facility to enter graphics direct were not available.

Start entering the program as normal. You should first set AUTO 10, on the basis that you will (or should) be avoiding the 'Remark' lines. When you come to a 'graphic' section, enter the quotes, then hit Shift and Right-arrow. Now hit the letter or key shown on the listing, and, all being well, you will get the requisite graphic character. The first occurs in line 20 — the 'L'. The remainder should be fairly apparent, but note carefully the abbreviations used, and hit the correct keys. Remember to return to 'normal' operation to input the trailing quotes. You should be making good use of your single keystroke facility. You may stop at line 420, since this is the end of the game.

When you list the program, you will probably be stunned by what the machine has done to your lovely graphics. It's gone and changed them all into keywords. You can't trust anything these days. However, don't worry, this is simply one of the machine's little foibles, and can be ignored, because the graphics will be all right.

Well, when I say all right, there is one small problem. You can't edit a line which includes graphic characters. Our friendly BASIC interpreter unjumbles all the codes when you are editing them, and

assumes you don't want them back! But fear not, help is at hand. At lines 430 to 500 is a whole additional program — a BASIC line searching system. In order to look at the innards of any line in your program, RUN 430. You will be asked for 'LINE NUMBER', which you should enter. It skips through all of the lines sequentially, until it comes to the one requested.

The display is quite interesting. It shows the memory location, together with its contents both in ASCII and character codes. You can move through by hitting 'Newline' ('Enter'), enter any replacement value, if required, or terminate by entering '999', or breaking. The first two items make up the memory address of the next line. The third and fourth are the line number; and you can alter this if you have need to. (How else did I get two line 50's on my listing ???). As you move through, you will see both 'tokens' and the character contents of the line, any of which you alter by simply inputting a new value.

Apart from having the facility to 'fix' lines which include graphics, you will no doubt have spotted that graphic characters can be inserted directly into a BASIC line, providing that the space has been made available. It is even practicable to put in 'control' characters. Take, for example, line 30. Input the line as:

```
30 X = "[6 SPC]"
      (in CT Standard notation)
```

Set the line-searcher to find line 30, and step through to the character after the first quote (Char 34). Now change the next six spaces (Char 32) to 24,24,24,24,24,26 and enter 999 to exit. When you LIST the line, you will see that it's a bit of an oddity. The LISTING process has taken each character literally, moving the pointer back (Char 24) five times, then down

(Char 26). However, the string 'X' is exactly the same as that which would have been produced by using CHR\$ and STRING\$.

If you are heavily into machine code, you will find the line-searcher a most convenient way of inserting the characters into an appropriate REM line. All in all, it is an extremely useful facility, and well worth tagging onto the end of any BASIC program under development, in order to give additional flexibility.

HOW WINDOW WORKS

The string array V (lines 40 to 130) holds 'big' numbers, based on a 10 by 9 pixel matrix. The array X represents 11 'frames' of the window breaking, which, when displayed consecutively, give a very realistic effect.

Line 300 flashes the ball, until the space bar is hit to send it on its way. It moves forward one pixel at a time, which means that it must be consecutively represented by two pairs of characters (line 320). Note that the delay, such as it is, is achieved by calling line 390. The process of actually finding this line is sufficiently long-winded to give an adequate delay, and the Return is immediate.

The last graphic character occurs in line 340, and lines 350 and 360 give special displays for zero, or maximum scores. The remaining lines display 'big' numbers, and even allow for some eggheaded genius who might hit a maximum 100 with five shots. In fact, scores over 90 would be considered outstandingly good.

THE LINE-SEARCHING FACILITY

Sixteen-bit numbers are stored with the least significant byte first, so that two consecutive eight-bit numbers A and B represent a 16-bit number $A + 256 * B$. Lines 490 and 500 pick up two bytes from a specified location, and carry out

Table 1. The TRS-80 keywords and their start locations (see text).

22 80 END	22 83 FOR	22 86 RESET	22 91 SET	22 94 CLS
22 97 CMD	22 100 RANDOM	22 106 NEXT	22 110 DATA	22 114 INPUT
22 119 DIM	22 122 READ	22 126 LET	22 129 GOTO	22 133 RUN
22 136 IF	22 138 RESTORE	22 145 GOSUB	22 150 RETURN	22 156 REM
22 159 STOP	22 163 ELSE	22 167 TRON	22 171 TROFF	22 176 DEFSTR
22 182 DEFINT	22 188 DEFNG	22 194 DEFDBL	22 200 LINE	22 204 EDIT
22 208 ERROR	22 213 RESUME	22 219 OUT	22 222 ON	22 224 OPEN
22 228 FIELD	22 233 GET	22 236 PUT	22 239 CLOSE	22 244 LOAD
22 248 MERGE	22 253 NAME	23 1 KILL	23 5 LSET	23 9 RSET
23 13 SAVE	23 17 SYSTEM	23 23 LPRINT	23 29 DEF	23 32 POKE
23 36 PRINT	23 41 CONT	23 43 LIST	23 49 LLIST	23 54 DELETE
23 60 AUTO	23 64 CLEAR	23 69 CLOAD	23 74 CSAVE	23 79 NEW
23 82 TAB	23 86 TO	23 88 FN	23 90 USING	23 95 VARPTR
23 101 USR	23 104 ERL	23 107 ERR	23 110 STRING*	23 117 INSTR
23 122 POINT	23 127 TIME*	23 132 MEM	23 135 INKEY*	23 141 THEN
23 145 NOT	23 148 STEP	23 152 +	23 153 -	23 154 *
23 155 /	23 156 C	23 157 AND	23 160 OR	23 162 >
23 163 =	23 164 <	23 165 SGN	23 168 INT	23 171 ABS
23 174 FRE	23 177 INP	23 180 POS	23 183 SQR	23 186 RND
23 189 LOG	23 192 EXP	23 195 COS	23 198 SIN	23 201 TAN
23 204 ATN	23 207 PEEK	23 211 CVD	23 214 CVS	23 217 CVD
23 220 EOF	23 223 LOC	23 226 LOF	23 229 MKI*	23 233 MKS*
23 237 MKD*	23 241 CINT	23 245 CSNG	23 249 CDBL	23 253 FIX
24 0 LEN	24 3 STR*	24 7 VAL	24 10 ASC	24 13 CHR*
24 17 LEFT*	24 22 RIGHT*	24 28 MID*		

this conversion, making due allowance for machines with more than 16 K. The first location searched (from line 430) is 16548, which is where the BASIC start-line pointer is stored.

As it reaches each line, it looks to see if it is the required number (line 440), and, if not, makes use

of the stored pointer to go to the next line, to continue the search.

Once the required line is found, it displays the location character value (putting "." if it is unprintable), and the ASCII code. Hitting 'Enter' moves to the next byte, without amendment (line 480). Alternatively, a new value

can be entered.

If you are among the select band of those with a machine possessing more than 16 K, you will note that location numbers go negative after 32767 — which is the standard TRS-80 method of handling PEEKs and POKEs in that range.

Listing 1. The Programmer's Aid.

```
20 REM --- *****
* PROGRAMMER'S AID *
* BY *
* PETER HEWITT *
*****

30 POKE 16561,40: POKE 16562,127: CLEAR 50: RUN 40
40 FOR I = 32538 TO 32754: READ A: POKE I,A: NEXT
50 DEFUSR0 = 32538: '---- FOR DOS USERS
50 POKE 16526,26: POKE 16527,127: '---- FOR TAPE USERS
60 A = USR(0): NEW
70 DATA 42,22,64,34,179,127,33,41,127,34,22,64,195,204,6,58,
186,127,183,40,46,58,187,127,60,50,187,127,32,7,42,32,
64,126,238,127,119,285,178,127,254,33,48,88,254,25,40,
91,33,181,127,6,5,79,126,185,40,5,35,16,249,121,201,62
80 DATA 133,144,201,58,188,127,183,32,38,205,178,127,254,25,40,
47,254,97,248,254,123,240,33,191,127,214,97,203,39,95,
22,0,25,66,35,94,235,126,230,127,50,188,127,34,189,127,
201,42,189,127,35,34,189,127,126,203,127,200,175,50,188
90 DATA 127,201,50,186,127,24,139,254,92,48,135,198,100,201,
175,50,186,127,62,95,42,32,64,119,195,41,127,195,227,
3,32,10,31,1,9,0,0,0,0
100 REM DATA PAIR FOR SHIFTED :-
110 DATA 23,157 'A
120 DATA 22,145 'B
130 DATA 24,13 'C
140 DATA 22,110 'D
150 DATA 22,163 'E
160 DATA 22,63 'F

170 DATA 22,129 'G
180 DATA 23,17 'H
190 DATA 23,135 'I
200 DATA 22,114 'J
210 DATA 24,0 'K
220 DATA 24,17 'L
230 DATA 24,28 'M
240 DATA 22,106 'N
250 DATA 23,32 'O
260 DATA 23,207 'P
270 DATA 24,22 'Q
280 DATA 22,150 'R
290 DATA 23,110 'S
300 DATA 23,141 'T
310 DATA 23,101 'U
320 DATA 22,204 'V
330 DATA 23,45 'W
340 DATA 22,133 'X
350 DATA 23,74 'Y
360 DATA 23,69 'Z
370 ' *****
* SPECIAL CODES ARE: *
* 128 = <SPACE> *
* 129 = <DOWN-ARROW> *
* 130 = <CLEAR> *
* 131 = <BREAK> *
* 132 = <RIGHT-ARROW> *
*****
```

Listing 2. The Window game.

```
9 REM *****
* W I N D O W *
* *
* b y *
* *
* P E T E R *
* H E W I T T *
*****

10 CLEAR 1000: DEFINT A-T: DEFSTR V-Z: DIM X(11)
20 W = "WWWWWWEEEEEEEEEEEEEEEE!!!!": WW = "": FOR I = 1 TO 25:
WH = W + MID$(W,I,1) + "L": NEXT
30 X = STRING$(5,24) + CHR$(26)

39 REM -- Big numbers !!
Abbreviations used are:
^ = <SPACE> (94=128)
b = <BREAK> (98=131)
c = <CLEAR> (95=130)
d = <DOWN-ARROW> (100=129)
r = <RIGHT-ARROW> (114=132)
L = <UP-ARROW> (91=131)
40 V(0) = "Zbbby" + X + "E^EE" + X + "KLLL"
50 V(1) = "E^EE" + X + "E^EE" + X + "E^EE"
60 V(2) = "Zbbby" + X + "T^T^" + X + "E^EE"
70 V(3) = "Zbbby" + X + "E^E^" + X + "E^EE"
80 V(4) = "E^E^" + X + "E^E^" + X + "E^EE"
90 V(5) = "E^E^" + X + "E^E^" + X + "E^EE"
100 V(6) = "Zbbby" + X + "E^E^" + X + "KLLL"
110 V(7) = "E^E^" + X + "E^E^" + X + "E^EE"
120 V(8) = "Zbbby" + X + "E^E^" + X + "KLLL"
130 V(9) = "Zbbby" + X + "E^E^" + X + "E^EE"
140 ZZ = "E^E^" + X + "E^E^" + X + "E^EE": X = X + CHR$(24)

149 REM -- Window-breaking graphics
150 X(1) = "E^E^E^" + X + "E^E^E^"
160 X(2) = "E^E^E^" + X + "E^E^E^"
170 X(3) = "E^E^E^" + X + "E^E^E^"
180 X(4) = "E^E^E^" + X + "E^E^E^"
190 X(5) = "E^E^E^" + X + "E^E^E^"
200 X(6) = "E^E^E^" + X + "E^E^E^"
210 X(7) = "E^E^E^" + X + "E^E^E^"
220 X(8) = "E^E^E^" + X + "E^E^E^"
230 X(9) = "E^E^E^" + X + "E^E^E^"
240 X(10) = "E^E^E^" + X + "E^E^E^"
250 X(11) = "E^E^E^" + X + "E^E^E^"

259 REM -- The actual window
260 X = X + CHR$(24): Y = "E^E^E^E^":
W = "E^E^E^E^" + X + "E^E^E^E^" + X + X + X + X + X + X + X + X + X + X + "E^E^E^E^"
270 CLS:PRINT86,
"TOTAL SCORE E^E^E^E^THIS E^E^E^E^LEFT E^E^E^E^HIGH SCORE":
279 REM -- Game start
280 PRINT @166, V(5): PRINT @128,ZZ: AA = 0: NN = 156:
GOSUB 420: NN = 140: GOSUB 420: NL = 5: TS = 0
290 Y = INKEY$: PRINT @632,W: XX = " ": PRINT @896,
"-----HIT <SPACE> TO START AND STOP -----"
300 Y = INKEY$: IF Y <> " " THEN IF XX = " " THEN XX = "b"
ELSE XX = " " ELSE PRINT @897,STRING$(56,32): GOTO 320
310 PRINT @896,XX: GOTO 300

319 REM -- Ball visible
320 FOR I = 896 TO 921: PRINT @I, "cd": GOSUB 390:
PRINT @I, "b": GOSUB 390: NEXT
329 REM -- Ball becomes invisible
330 PRINT @921, " ": FOR I = 922 TO 952:
IF INKEY$ <> " " THEN A = 1:
IF INKEY$ <> " " THEN A = 2: GOSUB 390: NEXT:
FOR I = 1 TO 11: PRINT @899, X(I): NEXT: SC = 0: GOTO 370

339 REM -- Show where the ball was
340 IF A = 1 THEN PRINT @I, "cd": ELSE PRINT @I, "b":
349 REM -- Calculate score, chicken if less than zero
350 SC = 18 - (952-I) * 2 + A: IF SC < 0 THEN SC = 0:
PRINT @910, "----++ C H I C K E N ! ! ++----": GOSUB 400

359 REM -- Big deal for a 20 score !!
360 IF SC = 20 THEN N = 0: M = 30: FOR I = 1 TO 50:
PRINT @896, LEFT$(W,I): M = M - 2: FOR J = 1 TO M:
NEXT J,I: GOSUB 400

369 REM -- Display score
370 GOSUB 410: NL = NL - 1: PRINT @166,V(NL):
IF NL > 0 THEN GOSUB 400: GOTO 290
ELSE IF TS > HS THEN HS = TS: NN = 186:
IF HS < 100 THEN AA = HS: FOR I = 1 TO 10: PRINT @180,ZZ:
PRINT @186,ZZ: GOSUB 390: GOSUB 420: GOSUB 390: NEXT
380 GOSUB 400: GOSUB 400: GOTO 280

389 REM -- Delays
390 RETURN
400 FOR K = 1 TO 500: NEXT: RETURN

409 REM -- Score display routines
410 AA = SC: NN = 156: GOSUB 420: TS = TS + SC:
IF TS < 100 THEN AA = TS: NN = 140: GOTO 420
ELSE V = V(0): PRINT @128,V(1): PRINT @134,V:
PRINT @140,V: PRINT @174,V(1): PRINT @180,V:
PRINT @186,V: RETURN
420 PRINT @ NN,ZZ: PRINT @ NN-6, ZZ: A = INT(AA/10):
B = AA - A * 10: PRINT @ NN, VCB: IF A = 0 THEN RETURN
ELSE PRINT @ NN - 6, VCB: RETURN
429 REM --
The BASIC line searching routine
430 J = 16548: GOSUB 490: I = L: INPUT "LINE NUMBER":N
440 J = I+2: GOSUB 490: PRINT L: IF L <> N THEN J = I:
GOSUB 490: I = L: GOTO 440
450 J = I - 1
460 J = J + 1: I = J: IF I > 32767 THEN I = I - 65536
470 PRINT I: L = PEEK(I):
IF L > 31 AND L < 192 THEN PRINT " "CHR$(L)" "
ELSE PRINT " "
479 REM -- Hit <NL> <<ENTER>> to move to next location
and '999' to terminate
480 PRINT L: A = 0: INPUT A: IF A THEN IF A = 999 THEN END
ELSE POKE I,A: GOTO 460 ELSE 460
490 IF J > 32767 THEN J = J - 65536
500 L = PEEK(J) + 256 * PEEK(J+1): RETURN
```


There's one
game you should play
with a home computer
before you buy it.

If you're looking for your first home computer, may we make a suggestion.

Tear out this page.

And ask these questions of every computer you look at.

1) Is the basic price reasonable, say under £180?

2) Does it work with a monitor as well as with an ordinary UHF T.V.?

3) Does it include a basic training manual that doesn't require a science degree to understand?

4) Does it have colour?

5) And sound?

6) Does it take cassettes?

7) And cartridges?

8) And can you operate them with joysticks working directly off the basic unit?

9) Does it have a professional quality keyboard that's guaranteed for twenty million depressions (and no headaches)?

10) Does it have colour graphics that are capable of producing detailed pictures?

11) Is the case robust enough to stand up to the kids?

12) Does it use a standard language that's not a million miles away from English?

13) Is there an expanding range of high quality software available from the makers?

14) Does the software include educational programs for adults as well as the very young?

15) And is there software

sophisticated enough to satisfy the experts?

16) Does it use the most up to date technology, for instance the 6809E microprocessor?

17) Will it drive a standard printer directly from the basic unit?

18) Is it made in the UK?

19) And for the basic price

will I get an easily accessible, yet large memory of at least 32K?

20) Or will I have to add lots of extras (and lots of money) for that much?

After you've finished pestering every computer salesman in sight, compare your answers to these, courtesy of the Dragon 32 (this is, after all, an ad for the Dragon).

Questions 1-19. Yes, yes, yes,
yes, yes, yes, yes, yes, yes, yes,
yes, yes, yes, yes, yes, yes, yes,
yes and yes. Question 20. No.

If you're thinking that that's a lot of computer for the money, you'd be right.

However, when you come to read the handbook you'll soon realise that something's missing.

The jargon usually associated with computers.

You see every part of the Dragon has been carefully designed to be easily understood, even by total beginners. Yet it has all the features an expert could want. Just ask it.

20 Questions.



TV, not included in price.

DRAGON 32

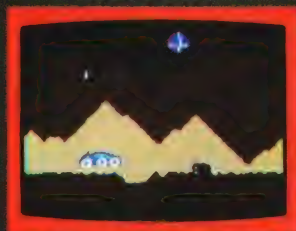
ANIROG SOFTWARE

COMPUTER GAMES
OF TOMORROW
AVAILABLE
NOW!

AS SEEN ON
T.V.!!



HEXPERT



MOON BUGGY



SKRAMBLE



3D TIME TREK

COMMODORE 64

NEW

GALAXY

AVOID CAPTURE BY THE ALIEN
MOTHER SHIPS TRACTOR BEAM AS
THE FIGHTERS DIVE BOMB YOU
100 SCREENS WITH A TWO PLAYER
OPTION K.B./J.S. £7.95

KONG K.B./J.S. £7.95

4 SCREENS WITH BRILLIANT ANIMATED GRAPHICS.

SKRAMBLE J.S. £7.95

6 SECTORS TO TEST YOUR SKILL

HEXPERT J.S. £7.95

TRAIN BERT TO BE HEXPERT ON THIS 3D HEXAGONAL PYRAMID.

MOON BUGGY J.S. £7.95

MANOEUVRE YOUR PATROL CRAFT OVER GIANT POT HOLES AS
YOU DEFEND THE MOON BUGGY FROM ALIEN ATTACK.

FROG RUN K.B./J.S. £5.95

A POPULAR ARCADE GAME. FUN FOR THE WHOLE FAMILY.

3D TIME TREK K.B./J.S. £5.95

SPECTACULAR 3D GRAPHICS STAR TREK GAME.

DUNGEONS K.B. £6.95

ENTER THE REALMS OF FANTASY IN THIS ROLE PLAYING GAME.

DARK DUNGEONS K.B. £6.95

2ND IN THE SERIES OF FOUR. DEFINITELY NOT FOR THE FAINT
HEARTED.

NEW APPROVED GAMES FOR
THE STACK LIGHT RIFLE

INDIAN ATTACK £5.95

COSMIC COMMANDO £5.95

VENGEANCE OF ZENO £5.95

24 HR. CREDIT CARD SALES HORLEY (02934) 6083
PAYMENT BY CHEQUE, P.O., ACCESS/VISA
8 HIGH STREET HORLEY, SURREY.
Overseas 50p post & packaging

TRADE ENQUIRIES WELCOME

29, West Hill, Dartford, Kent. (0322) 92513/8

Dr. Barry Landsberg

SOME NOTES ON THE APPLE

Simple music routines for the Apple have several limitations, even given the speed of machine code. These new programs provide superior performance and are suitable for any 6502 machine which strobes a loudspeaker or cassette output.



Have you ever used an Apple II machine code subroutine to produce music, either as supplied in any Applesoft program that plays music or typed in from one of many articles on Apple music that have appeared in the past? If so, it will probably be something based on the program given in Listing 1, although it might be located at an address other than \$0302. (Throughout this article, any number prefixed with a '\$' refers to a hexadecimal number, while no such prefix means the number is in decimal notation — for example \$0302 is the same as 770). This kind of routine may be used to make the Apple play useful, but somewhat limited, music.

In the example given, address \$0300 contains a one-byte number which controls the pitch of the note

produced, while \$0301 contains a one-byte number which controls the duration of the note. The principle on which this routine works is that any access to the address \$C030 (in Listing 1 by the command LDA \$C030) changes the voltage on the Apple's loudspeaker from +5 V to 0 V, or from 0 V to +5 V, and doing this at regular intervals gives rise to the nearest

0302-	AD 30 C0	LDA	\$C030
0305-	88	DEY	
0306-	D0 05	BNE	\$030D
0308-	CE 01 03	DEC	\$0301
030B-	F0 09	BEQ	\$0316
030D-	CA	DEX	
030E-	D0 F5	BNE	\$0305
0310-	AE 00 03	LDX	\$0300
0313-	4C 02 03	JMP	\$0302
0316-	60	RTS	

PROGRAM 1

approximation to a musical note that the Apple can perform without hardware modification — a square-wave! The rest of this short routine consists merely of timing loops. The first timing loop decrements the 6502 Y-register (which is not given an initial value by the routine!) and then whenever Y is zero, will decrement the number stored in \$0301 until that is zero before exiting the routine. It can thus be seen that the value held in \$0301 controls the duration of the note, and the routine will pass through the DEY instruction approximately $256 \star (T-1)$ times, where T represents the contents of address \$0301. The exception to this is when $T=0$ which acts as though its value were 256.

The X register is loaded with the contents of \$0300 (which we shall call P) and is decremented on each pass through the loop, and when X becomes zero, address \$C030 is accessed (thus strobing the loudspeaker) and then X register is 'refreshed' with P. It is therefore evident that P controls the timing between each call to \$C030, and thus controls the pitch of the note — lower values of P give rise to a higher pitch with the important exception that $P=0$ produce the lowest pitch possible using this routine.

This subroutine may be accessed from machine code using the following lines:

```
LDA #000
STA $0300
LDA #000
STA $0301
JSR $0302
:
:
```

or alternatively from BASIC:

```
T = 0
P = 0
POKE 768,T
POKE 769,P
CALL 770
:
:
```

Either of these two examples will produce the lowest, longest note available using this routine — approximately the G below middle C sounding for about five-eighths of a second.

To produce music from BASIC, all kinds of variations may be used to set up \$0300 and \$0301 with the desired values of T and P before calling \$0302 — for example defining an ASCII string containing the musical information, reading DATA statements or numbering the notes and using a

lookup table for the correct value of P. I prefer a combination of the last two as it makes programming and transportation (playing the tune a little higher or lower) far easier!

Having analysed the routine given in Listing 1, let us now list some of its limitations.

- The higher end of the range (ie values of P below 50) starts to become quite out of tune. For example, as the difference in frequency between P=39 and P=40 is about 2.5% in frequency while an interval of a semitone corresponds to a difference of about 5.9%, it is difficult to construct a semitone interval in this region.
- The lowest note playable is the G below middle C, which is by no means a low note.
- The longest note playable is about five-eighths of a second, and there is no satisfactory way of stringing two notes together to make a longer note (as can be done on the BBC microcomputer, for example) as even the shortest machine code routine to do this gives rise to a noticeable interruption.
- There is no natural provision for pauses, and to get them one may have to resort to tricks like ugly delay loops in BASIC, or a second machine code routine which is almost identical to that of Listing 1 except that LDA \$C030 is replaced by an address which does not strobe the loudspeaker (perhaps LDA \$0300) and can be called to give an accurately-timed interval of silence!

The first two limitations together mean that a tuneful range of less than three octaves can be produced, and the combination of drawbacks ensures that an ambitious desire to get the Apple to play something like the opening bars of 'Toccata and Fugue in D minor' by Bach is almost impossible. The remainder of this article will discuss a superior musical routine which overcomes the last three of these limitations, and which allows the Apple to give a rendering of the Toccata.

A NEW MUSIC SUBROUTINE

The fundamental idea of the new subroutine is simply to use the equivalent of two-byte numbers of control the pitch and timing instead of one-byte numbers as in Listing 1. Whereas Listing 1 uses essentially three counters for the timing loops (ie X, Y and address \$0301), the new routine will have



to use five. Having chosen the X and Y registers to control the pitch of the note, the problem now is to choose the three other timing loop counters in such a way that no great loss of timing efficiency is effected, otherwise the usefulness of the routine will be curtailed. Furthermore, it is the first of these counters whose efficiency is the most important as it is decremented 255 times before the second counter is even accessed. In principle, use of the accumulator is by far the fastest method as commands such as ADC #\$01 use only two of the microprocessor clock cycles, while the DEC (decrement) command uses five cycles even in the fastest (ie zero-page) mode! It is, in fact, possible to use the accumulator as a counter if the command LDA \$C030 (which takes four clock cycles and destroys the contents of the accumulator) is replaced by BIT \$C030 (which also takes four cycles, but does not affect the accumulator). I chose to use ADC #\$01 as the counter step as it automatically clears the CARRY flag unless the accumulator contains the value #\$FF. The zero-page addresses \$FE and \$FF, which are used by neither DOS or APPLESOFT BASIC, were chosen

as the final two counters, and the addresses \$FC and \$FD were chosen to 'refresh' the X and Y registers with the values to control the pitch as discussed earlier.

The final limitation to overcome is the inability to create a pause. The solution to this lies in calling BIT \$C030 after one complete cycle of the pitch loop instead of before, as is done in Listing 1. Even for a low-pitched note at 100 Hz, this results in a delay of only 1/200 of a second as each cycle consists of two strobes to the loudspeaker; but as the routine is actually capable of going lower than 1 Hz if a value of zero is poked into addresses \$FC and \$FD, pauses of up to over half a second may be programmed.

The new routine is given in Listing 2, and the timing of the loops is such that it is as efficient as Listing 1 in spite of the fact that it has two-byte counters instead of one! The result of this is that the numbers needed to generate any note in Listing 1 are very close to (but not exactly the same as) those needed to generate the same note in Listing 2.

It is interesting to note that Listing 2 could have been made even more efficient, as after incrementing the accumulator we reach the command BNE \$0313 and the program branches 254 times out of 253 (not 256 because of the way the CARRY flag is set). When any branch command is reached, it takes two cycles to complete if the branch is ignored, but three cycles if the branch is executed. Listing 2 was then rearranged in such a way that the BNE command was replaced by a BEQ command, either branching to the commands which decrement the zero-page addresses, or slipping through to the DEX command. This routine was indeed about 10% more efficient than Listing 2 and all other things being equal would increase the musical range by two semitones — but by decreasing the timing of the loop when it does not branch we increase the timing when it does branch. This results in the higher notes in the range sounding very rough indeed due to the larger timing inequality, and Listing 2 probably represents the best compromise between timing efficiency and musical acceptability.

INTERFACING WITH BASIC

In order to get this routine to play music from a BASIC program, it is

0300-	A9 00	LDA	#\$00
0302-	A6 FD	LDX	\$FD
0304-	A4 FC	LDY	\$FC
0306-	69 01	ADC	#\$01
0308-	D0 08	BNE	\$0312
030A-	C6 FF	DEC	\$FF
030C-	D0 04	BNE	\$0312
030E-	C6 FE	DEC	\$FE
0310-	F0 0C	BEQ	\$031E
0312-	CA	DEX	
0313-	D0 F1	BNE	\$0306
0315-	88	DEY	
0316-	D0 EE	BNE	\$0306
0318-	2C 30 C0	BIT	\$C030
031B-	4C 02 03	JMP	\$0302
031E-	60	RTS	

PROGRAM II

VALUES OF THE PITCH PARAMETER P NEEDED TO PRODUCE MUSICAL NOTES

NOTE VALUE	NOTE	VALUE OF P	NOTE VALUE	NOTE	VALUE OF P
1	C	768	25	MIDDLE C	191
2	C#	724	26	C#	180
3	D	686	27	D	170
4	D#	646	28	D#	160
5	E	610	29	E	151
6	F	576	30	F	143
7	F#	544	31	F#	134
8	G	514	32	G	126
9	G#	485	33	G#	119
10	A	458	34	A	113
11	A#	432	35	A#	106
12	B	408	36	B	100
13	C	384	37	C	95
14	C#	362	38	C#	89
15	D	342	39	D	84
16	D#	322	40	D#	80
17	E	304	41	E	75
18	F	287	42	F	71
19	F#	271	43	F#	67
20	G	256	44	G	63
21	G#	241	45	G#	60
22	A	228	46	A	56
23	A#	215	47	A#	53
24	B	203	48	B	50
			49	C	47
			50	C#	44

TABLE 1

important to convert the frequency parameter P into a two-byte number in such a way that increasing P will always decrease the pitch of the note produced. To do this is not totally straightforward because the routine takes a value of #500 in any of the counters as formally representing the number 256 and takes #501 as formally representing zero due to the way the routine decrements the counter first and then asks if it is zero. It is lines 40 and 50 in Listing 3 which perform this conversion.

Next, we want to relate musical

notes to values of P, and taking the lowest note playable as being two octaves below middle C, the values needed for each note were determined by measurements with a frequency counter and are listed in Table 1. The highest note listed is P=44 which gives a rise to a top C#, but for the next note (top D), P=42 would be about 0.2 semitones too low and P=41 would be about 0.2 semitones too high. In all, a tuneful range of just over four octaves is represented. Naturally, still higher values of P give rise to even lower

frequencies, but they tend to sound more like a harsh buzz than a musical note.

Once the program is written, the most tedious part is typing in the melodic data, and the most convenient way to do this is call the bottom C note number 1, the next, C#, note number 2 and so on, and to store the relevant values of P in an array. The element N(0) holds the highest number of P that can be converted to a two-byte number as described above (ie \$FF00), and as this gives rise to a frequency of less than 1 Hz, asking for note zero may be used to program pauses. The only limitation to this is that values of T greater than 255 should not be used for pauses or else an audible click may be generated, but this value of T corresponds to about five-eighths of a second, and any number of consecutive pauses may be strung together! The DATA statements 2-5 in Listing 3 contain the information given in Table 1, which is read into the array N in the subroutine starting at line 1000. This way of arranging things has the advantage not only of easier programming from, say sheet music, but also allows the melody to be played any number of semitones higher or lower (as long as all the relevant values are stored in the array) simply by inserting, for example, IF I THEN I=I+4 at the end of line 30 in order to generate the same melody four semitones higher. The reason for the IF is that the pauses specified by I=0 should not be transposed upwards into extraneous deep notes, or downwards to generate an "ILLEGAL QUANTITY ERROR".

Listing 3 shows a complete realisation of the last few bars of the melody 'Pizzicato' by Delibes. It is a good choice for this method of generating music because there are so many BASIC instructions between each note that the gaps between them are very noticeable. This is the first real disadvantage of this kind of routine as these gaps can be very irritating for certain pieces of music. There are two possible ways around this problem. Firstly, we could use an Applesoft compiler to speed up the execution of the program — it works very well but it is a sloppy method to use as it generates vast quantities of inflexible code. Secondly, we could write a simple machine code interface called from BASIC in order to achieve our final objective — a flexible, easy-to-install music routine. In fact, we are going to do just that!

PROGRAM III

```

2 DATA 65279,768,724,686,646,610,576,544,514,485,458,432,408
3 DATA 384,362,342,322,304,287,271,256,241,228,215,203
4 DATA 191,180,170,160,151,143,134,126,119,113,106,100
5 DATA 95,89,84,80,75,71,67,63,60,56,53,50,47,44
10 GOSUB 1000
20 FC = 252:FD = 253:FE = 254:FF = 255:TF = 256:UN = 1
30 READ I,T
35 IF T = 0 THEN GOTO 100
40 P = N(I):P1 = INT (P / TF) + UN:T1 = INT (T / TF) + UN
50 P2 = P - TF * INT ((P + UN) / TF) + UN:T2 = T - TF * INT ((T + 1) / FF) + UN
60 POKE FC,P1: POKE FD,P2: POKE FE,T1: POKE FF,T2: CALL 768: GOTO 30
100 END
130 DATA 1,50,20,50,15,50,18,50,13,50,17,50,20,50,22,50,25,50
140 DATA 24,50,0,50,27,50,0,50,32,50,0,110
150 DATA 22,50,25,50,20,50,24,50,18,50,22,50,24,50,27,50,30,50
160 DATA 29,50,0,50,32,50,0,50,37,50,0,110
170 DATA 20,48,25,48,20,48,23,48,22,48,27,46,22,46,25,46,24,46
180 DATA 29,44,24,44,27,44,24,44,25,42,27,42,29,42,30,42
190 DATA 32,40,29,40,30,40,31,40,32,38,33,38,34,38,36,38,37,36,0,36,32,34,0,34,37,68
500 DATA 0,0
1000 DIM N(50)
1010 FOR I = 0 TO 50: READ N(I): NEXT I
1020 RETURN

```


PROGRAM IV

```

031F- A9 40      LDA #$40
0321- 85 FA      STA $FA
0323- A9 00      LDA #$00
0325- 85 F9      STA $F9
0327- A0 00      LDY #$00
0329- B1 F9      LDA (F9),Y
032B- 85 FC      STA $FC
032D- C8         INY
032E- B1 F9      LDA ($F9),Y
0330- 85 FD      STA $FD
0332- C8         INY
0333- B1 F9      LDA ($F9),Y
0335- 85 FE      STA $FE
0337- C8         INY
0338- B1 F9      LDA ($F9),Y
033A- 85 FF      STA $FF
033C- C9 01      CMP #$01
033E- D0 07      BNE $0347
0340- A5 FE      LDA $FE
0342- C9 01      CMP #$01
0344- D0 01      BNE $0347
0346- 60         RTS
0347- 18         CLC
0348- A5 F9      LDA $F9
034A- 69 04      ADC #$04
034C- 85 F9      STA $F9
034E- 90 02      BCC $0352
0350- E6 FA      INC $FA
0352- 20 00 03   JSR $0300
0355- 4C 27 03   JMP $0327

```

In order to generate smooth organ-like music on the Apple it is necessary to ensure that the time interval between the notes is as short as possible. However, if we want a system that can be programmed easily and is flexible, we really want to be in BASIC, slowed down even more by our reading DATA statements and our accessing an array! These conflicting demands can be met if

we get BASIC to do all the work **before** it calls the music routine by storing the musical information in a reserved area of memory, and then calling a machine code routine to step quickly and efficiently through the melody. The machine code routine is necessary for this is shown in Listing 4, which is started at location \$031F which is the address immediately after that of Listing 2. It takes the first four bytes from the buffer (which I chose to start at \$4000), stores them in \$FC-\$FF and calls Listing 2, and will continue doing so until the bytes corresponding to T=0 are encountered. A word of warning here — if you wish to use this music package with a program that calls HGR2 (ie the second page of high-resolution graphics, which overwrites the area \$4000-\$5FFF), the music buffer should be relocated to \$6000.

Once Listings 2 and 4 are in memory, Listing 5 may be run. The value of 16184 which the variable AD is initially given refers to the address \$4000, and the program will convert the DATA statements in line 130 onwards into two-byte quantities and store them in memory. When this is done, the statement CALL 799 will initiate Listing 4. The DATA statements contain the opening bars of 'Toccata and Fugue in D minor' by Bach in as much glory as the Apple can possibly give to it!

Imagine we wanted to play the 'Pizzicato' keeping the staccato effect of the melody, but using the machine code routines as outlined above — surely we need to type in

twice as much data to accommodate the pauses? Certainly not — if we substitute the DATA statements of Listing 3 into those of Listing 5 we get a somewhat faster 'Legato', but inserting the following line:

```

55 POKE AD,0: POKE AD+1,0: POKE
   AD+2,1: POKE AD+3,25: AD=AD+4

```

into Listing 5 will produce the desired effect.

The method I use to integrate all this into an easily used and coherent system is to set up the two machine-code routines (Listings 2 and 4) while in the HELLO program, either by POKEing the instructions one byte at a time or preferably by BLOADing them, and simply using a system based on Listing 5 with the relevant set of DATA statements for each different melody. The penalties to be paid for using this system are, first, that an area of memory from \$4000 upwards (or from wherever you choose to start) is taken up with the musical information, and second, for a piece of music of any significant size, there is a considerable time delay between running the program and it actually playing the first note of the melody. This delay works out to be approximately 1/20 a second for each note or pause in the DATA statements. However, once the BASIC program has been run, any subsequent call to \$031F (eg CALL 799) will initiate a replay of the melody immediately — provided, of course, that the area has not been overwritten by another part of the program. For example, having run Listing 5 once, we may load another BASIC program or even reboot by typing PR#6, and CALL 799 will still play the Toccata.

Finally, there is no reason why you should not BSAVE a very long piece of music (which might have taken the BASIC program minutes to set up) and store it on disc as part of a music library. The musical information can then be BLOADED (and even relocated if necessary), and as long as Listings 2 and 4 are in memory, any CALL 799 will immediately produce the melody. It is important that all of the melodic information is saved, as Listing 4 will not stop stepping through memory until it reaches the marker for T=0, that is two consecutive bytes each containing the value #\$01.

Having demonstrated a way to string individual notes together to make a melody, next month's article develops a method of enriching the tone quality of each note and examines in more detail the strobe of the APPLE's loudspeaker.

PROGRAM V

```

2 DATA 65279,768,724,686,646,610,576,544,514,485,458,432,408
3 DATA 384,362,342,322,304,287,271,256,241,228,215,203
4 DATA 191,180,170,160,151,143,134,126,119,113,106,100
5 DATA 95,89,84,80,75,71,67,63,60,56,53,50,47,44
10 GOSUB 1000
20 AD = 16384:TF = 256:UN = 1
30 READ I,T
40 P = N(I):P1 = INT (P / TF) + UN:T1 = INT (T / TF) + UN
50 P2 = P - TF * INT ((P + UN) / TF) + UN:T2 = T - TF * INT ((T + UN) / TF) + UN
60 POKE AD,P1: POKE AD + 1,P2: POKE AD + 2,T1: POKE AD + 3,T2:AD = AD + 4
70 IF T THEN 30
100 CALL 799:END
130 DATA 46,24,44,24,46,672,0,240,0,240,44,240,42,60,41,60,39,60,38,120,39,480
140 DATA 0,240,0,240,34,24,32,24,34,672,0,240,0,240,29,120,30,120,26,120,27,480
150 DATA 0,240,0,240,22,24,20,24,22,672,0,240,0,240,20,60,18,60,17,60,15,60,14,120,15,480
160 DATA 0,240,0,240,3,960,14,240,17,240,20,240,23,240,26,240,29,480
170 DATA 0,240,22,240,17,240,19,480,0,240
180 DATA 26,72,27,48,29,48,26,48,27,48,29,48,26,48,27,48,26,48,27,72,29,72
190 DATA 30,48,32,48,29,48,30,48,32,48,29,48,30,48,32,48,29,48,30,72,32,72
200 DATA 34,48,35,48,32,48,34,48,35,48,32,48,34,48,35,48,32,48,34,72,0,240
210 DATA 38,72,39,48,41,48,38,48,39,48,41,48,38,48,39,48,41,48,38,48,39,72,41,72
220 DATA 42,48,44,48,41,48,42,48,44,48,41,48,42,48,44,48,41,48,42,72,44,72
230 DATA 46,48,47,48,44,48,46,48,47,48,44,48,46,48,47,48,44,48,46,48,0,240
240 DATA 46,48,44,48,47,48,41,48,44,48,47,48,41,48,44,48,47,48,41,48,44,48,39,48
250 DATA 41,48,44,48,37,48,41,48,44,48,37,48,41,48,44,48,37,48,41,48,44,48,35,48
260 DATA 37,48,41,48,34,48,37,48,41,48,34,48,35,48,39,48,32,48,35,48,39,48,32,48
270 DATA 34,48,37,48,30,48,34,48,37,48,30,48,32,48,34,48,29,48,32,48,35,48,29,48
280 DATA 30,48,34,48,27,48,30,48,34,48,27,48,29,48,32,48,26,48,29,48,32,48,26,28,0,240
290 DATA 3,660,14,240,17,240,20,240,23,240,26,240,29,240,32,240,35,528
300 DATA 34,48,32,48,30,48,29,48,27,48,26,48,24,48,26,96,22,96,26,96,29,48,32,48
310 DATA 30,24,32,24,30,24,32,24,30,24,32,24,30,24,32,24,30,96,29,96,27,48,0,48,27,256
500 DATA 0,0
1000 DIM N(50)
1010 FOR I = 0 TO 50: READ N(I): NEXT I
1020 RETURN

```


sinclair **special**

6



Inside...

***Setting new standards in
educational software with
Sinclair-Macmillan***

Plus six other learning programs

TODAY, LEARNING IS A NEW GAME

Subsidised microcomputers are now commonplace as teaching aids for the very youngest children and the ZX Spectrum is prominent amongst those micros at use in schools.

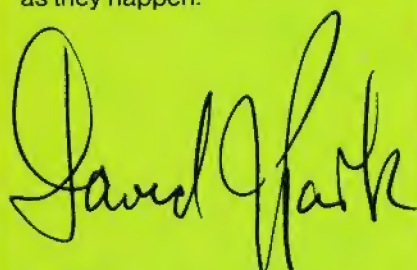
In the relatively short time that the Spectrum has been at work in the classroom, two questions have been answered. Yes: with the right software, the micro can and does teach effectively and thoroughly (and gives teachers more time to devote to individual pupils). Yes: young children think little of working rapidly and successfully, with a screen and keyboard, on even quite complex subjects.

In this Sinclair Special we reveal a range of educational software specifically designed to make full use of these advantages. The programs produced by Sinclair in collaboration with Macmillan Education are fascinating. They deal imaginatively and most effectively with early reading skills and take a truly refreshing approach to basic science.

In the Blackboard range we've programs which bring a light-hearted clarity to the tricky matters of spelling and punctuation.

These programs are designed for use both at home and in the classroom. Each program is accompanied by full documentation which gives parents helpful advice and guidance on the educational objectives.

The programs covered on these pages represent only a fraction of the full and fast-growing list of Spectrum software. Be assured we'll keep you in touch with new developments as they happen.



David Park
Education Marketing Manager

NEW WAYS TO LEARN WITH THE ZX SPECTRUM[™]

Programs from Blackboard Software

The new range of educational programs from Blackboard Software makes learning an enjoyable process by involving the child in a game which teaches as it entertains.

Each program has a step-by-step example section and gives correct answers after a number of attempts. Vocabulary changes can be made, allowing each program to keep pace with the child's development. This flexibility can also be used in the classroom to cater for children of differing ability.

The instructive and colourful games which follow the successful completion of each group of sentences provide useful practice in letter recognition and increase familiarity with the Spectrum keyboard.

All programs are written for the 48K RAM Spectrum.



Alphabet Games

Three games of letter recognition (using either upper or lower case) to help children learn the alphabet and find their way round the computer keyboard.

Alphagaps — The full alphabet is displayed, along with a second, incomplete version. The child must fill in the missing letters.

Random Rats — Press the letter key that is displayed on the gun to destroy the rats which have invaded the cellar!

Invaders — Stop little green men from landing on Earth by pressing the appropriate letter.

Early Punctuation

While an animated matchstick man marches above displayed sentences the child must decide which punctuation mark is missing and where to insert it. At the touch of a key the matchstick man drops the mark into place. After successful completion of every sentence in the exercise, light relief comes in the form of a bottle-shooting game!

The Apostrophe

As each sentence is displayed, a bird appears with a worm in its beak. The keyboard is used to move the bird and drop the worm into the correct place for the apostrophe. When ten sentences have been corrected, the Grub Game is displayed. Press the correct character to change the grub into a butterfly...before it munches through a flower!

Capital Letters

A program to teach the use of capital letters. Sentences incorporating proper nouns and sentences without opening capitals are displayed. The child inserts the correction by guiding an animated figure to the appropriate letter.

For each correct answer an apple grows on a tree. After ten correct answers the child's skills in recognising letters and using the Spectrum keyboard are needed to save the apples as they fall to the ground.

Speech Marks

A comprehensive program including sentences with one or two sets of speech marks ("inverted commas") and exercises in both direct and reported speech.

Using the Spectrum keyboard, a cursor is used to guide speech marks to the correct position. The program offers three levels of difficulty, with full examples for each section. Guide Max the mouse through a maze, after the correct completion of five sentences from each section, but beware of Persian cats!

Castle Spellerous

A spelling game with ten levels of vocabulary, including words with silent first letters, double letters and other difficult words. The Princess has been captured and carried off to Castle Spellerous. Helped by ten soldiers, the child can attempt a rescue by giving the right answers. Part of a siege tower is built for each correctly spelt word. Mistakes are costly — the wicked wizard appears as a vampire bat, turning the men into frogs, butterflies and bats!

When ten words are spelt correctly the rescue begins and the wizard takes flight.

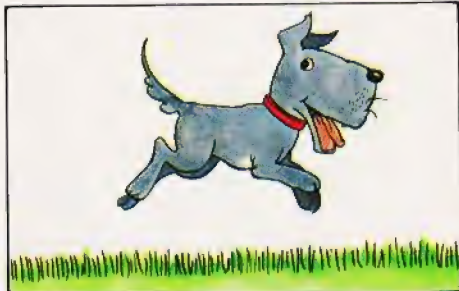
SINCLAIR + MACMILLAN: A NEW DIMENSION IN EDUCATIONAL PROGRAMS

Sinclair have joined forces with Macmillan Education to produce a completely new and different range of educational software. The results so far can be seen in these exceptional programs.

The Learn to Read series is derived from Macmillan Education's best-selling primary school reading scheme, Gay Way. It offers a unique opportunity for parents and

teachers to participate in the child's first experience in reading.

Macmillan Education's Science Horizons is one of Britain's most successful school science schemes. Each program concentrates on key scientific ideas and, through simulation of real life, makes the learning process entertaining and enjoyable.



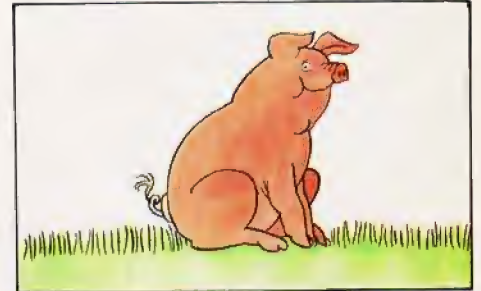
Learn to Read 1

Learn to Read 1 is designed for children who are just beginning to read. It is in four parts, each of which develops skills central to the reading process — letter recognition, sight vocabulary, early spelling and memory. The program is full of colour and fun and children will enjoy learning to read as they meet the animal characters — Ben the dog, Jip the cat and their friends.



Learn to Read 2

Learn to Read 2 extends the fundamental reading skills practised in the first program, as well as encouraging logical thinking. The child's vocabulary is gradually built up as new words such as "red," "green," "car," "ship" and "bus" are introduced. In addition, Learn to Read 2 features an attractive 'reward' system enabling children to see their achievements grow.



Learn to Read 3

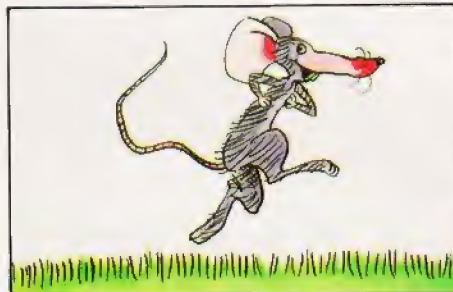
Learn to Read 3 builds on the child's progress so far, so that he or she can gain the confidence to move on through the complex reading process. Learn to Read 3 features four different activities, all of which are colourful and lively. Further vocabulary is introduced until the child is reading more than 30 words.



Learn to Read 4

Learn to Read 4 is the alphabet program in the Learn to Read series.

Using various stimulating activities the program gives the child plenty of practice in working with the alphabet — matching initial letters to words and pictures and spotting missing letters. These exercises build familiarity with simple sequences within the alphabet.



Learn to Read 5

Learn to Read 5 teaches positional language — often difficult to understand and remember — by using words and phrases such as "behind" and "in front of," "inside" and "outside."

The program first demonstrates the meanings of the words using clear pictures. It then tests the child's understanding of the words in two lively games.



Cargo

Set sail around the world. Choose your ports of call — New York, Tokyo, Belem, Helsinki — then the real challenge begins! You must reach your destinations safely, weathering storms on the way. But first, load your cargo — using all your knowledge and skill. Poor loading can mean capsizing and sinking. Your rank, if not your life, is always at stake!



Glider

Be a glider pilot! The glider models real-life gliding conditions so that you can learn through experience. As the pilot you must consider the time of day, the amount of cloud cover and the kind of terrain below you in order to find the up-currents of air that will keep you airborne. Try to fly as far as possible and, when you are high enough, navigate your way back to your home airfield and land safely — if you can.



Survival

Discover what it is like to be an animal in the wild! Be a lion stalking your prey, escaping human hunters. Or be a hawk, mouse or even a butterfly, searching for food and avoiding predators.

Survival models the natural world and brings to life hazards that different creatures must face in their struggle to stay alive.



Magnets

With an army of small magnets you set out to conquer the powerful supermagnets of your opponent. You have one weapon — your forces of magnetic attraction and repulsion.

The strategy is simple: attract smaller magnets to build strength to repel the supermagnet. When cornered, just turn your poles on your enemy and see what happens!

Learn to Read and Science Horizons programs are written for a 48K RAM Spectrum, and are supplied complete with comprehensive supporting documentation for parents and teachers.

ZX INTERFACE 2

THE NEW ROM CARTRIDGE AND JOYSTICK INTERFACE

Now available in shops



Loads programs instantly
Takes two joysticks
Just plug-in and play

The ZX Interface 2 is the latest new peripheral for the ZX Spectrum system. It enables you to use new ZX ROM cartridge software: plug-in programs that load instantly. There are ten terrific games already available on cartridge. ZX Interface 2 also allows you to use

one or two standard joysticks without the need for separate special interfaces.

To use new ZX ROM Cartridge programs, just connect Interface 2 to the rear of your Spectrum or Interface 1 and plug in the cartridge of your choice. Switch on and the program is then loaded, ready to run!

You can use any joystick that has a 9-way D plug. Use one or two of them for extra fun with suitable ZX ROM cartridge or Sinclair cassette programs — or with dozens of other Spectrum programs.

ZX MICRODRIVE/ ZX INTERFACE 1

The ZX Microdrive System is unique. This compact, expandable add-on system provides high-speed access to massive data storage. With just one Microdrive and a ZX Interface 1 you'll have at least 85K bytes of storage, the ability to LOAD and SAVE in a matter of seconds, the beginnings of a local area network of up to 64 Spectrums and a built-in RS232 interface. The cost? Less than £80.

How to get ZX Microdrive and ZX Interface 1

Spectrum owners who bought direct from us by mail order have been sent full details. Order forms are being mailed in strict rotation. If you haven't yet received your order form please bear with us. We're making good progress in meeting the huge demand.

If you didn't buy your Spectrum by mail order, send us the form at the bottom of this page and we'll add your name to the mailing list.

How to order

Complete the appropriate sections on the order form below. Note that there is no postage or packing to pay on software purchases. Orders may be sent FREEPOST (no stamp needed). Credit card holders may order by phone, calling 01-200 0200, 24 hours a day. Please allow 28 days for delivery.

™ Sinclair, ZX Spectrum, ZX Microdrive, ZX, ZX Interface are trade marks of Sinclair Research Ltd.

sinclair™

Sinclair Research Ltd, Stanhope Road, Camberley, Surrey, GU15 3PS. Telephone: (0276) 685311.

To: Sinclair Research Ltd, FREEPOST, Camberley, Surrey, GU15 3BR.

Section A: Hardware

Qty	Item	Code	Item Price £	Total £
	ZX Interface 2	8501	19.95	
	ZX Spectrum - 48K	3000	129.95	
	ZX Spectrum - 16K	3002	99.95	
	Postage and packing: orders under £90	0028	2.95	
	orders over £90	0029	4.95	
			TOTAL £	

Section B: Software

E10/S	Learn to Read 1	4309	9.95
E11/S	Learn to Read 2	4310	9.95
E12/S	Learn to Read 3	4311	9.95
E13/S	Learn to Read 4	4312	9.95
E14/S	Learn to Read 5	4313	9.95
E15/S	Cargo	4314	9.95
E16/S	Glider	4315	9.95
E17/S	Survival	4316	9.95
E18/S	Magnets	4317	9.95
E19/S	Early Punctuation	4318	9.95

ORDER FORM

E20/S	Speech Marks	4319	7.95
E21/S	Apostrophe	4320	7.95
E22/S	Capital Letters	4321	7.95
E23/S	Castle Spellerous	4322	7.95
E24/S	Alphabet Games	4323	7.95
			TOTAL £

*I enclose a cheque/postal order made payable to Sinclair Research Ltd for £

*Please charge my Access/Barclaycard/Trustcard account no.

*Delete/complete as applicable.

Signature

Mr/Mrs/Miss

Address

COT 401

(Please print)

ZX Microdrive™ information request

Please add my name to the Microdrive Mailing List and send me a colour brochure with full specifications of ZX Microdrive/Interface 1 ☐ (tick here).

Free Sinclair ZX™ Software Catalogue

Please reserve my priority copy of the January 1984 Sinclair ZX Spectrum Software Catalogue ☐ (tick here).

Please use the form above to send your name and address.

Don Thomasson

ELECTRON UNDER THE MICROSCOPE

Inevitably the Electron has been described as a cut-down BBC. We look at the latest price of Acorn hardware to see if this is a fair verdict.

A person who buys a racehorse want to know its pedigree, and if none is available the value of the animal will be considerably reduced. The Electron has a respectable family background, and that will enhance its chances of success, though it may not have all the advantages which were exhibited by its ancestors.

It is tempting to review it on a basis of comparison with the BBC computer, with which it is broadly compatible, but that would not be helpful to those unfamiliar with the earlier machine. On the other hand, some comparisons are unavoidable, because certain features have clearly been included for the sake of compatibility, and would be rather mystifying if treated solely in isolation.

THE EQUIPMENT

Packed in the familiar kind of polystyrene foam box, the Electron emerges sideways, rather than lifting out horizontally, as if it was asserting a claim to be different right from the start. Its removal reveals a little bag of moisture-absorbing pellets, an encouraging indication of attention to detail, perhaps more necessary in a device which has clearly travelled far and through moist climates ("Assembled in Malaysia" is embossed in the plastic). The main unit is chunky in appearance, its case made of hard and tough plastic, more robust than some cases and entirely practical. The maximum dimensions are roughly 13½" wide, 6¼" deep, and 2¼" high.

A second unit plugs directly into a three-pin mains socket, which may be inconvenient for sockets with limited clearance round them. This is not a power supply, merely an isolating transformer delivering 18-19 V AC at 14W. There is no on-off switch, the need for one being reduced by the fact that a single supply is involved, so there is no harm in unplugging the transformer output from the main unit. This connection is made at the right-hand end of the main unit.

At the left hand end are four connectors. There is the UHF output to a television set, and the DIN socket for the cassette recorder. More surprising are the video and RGB outputs — surprising because a colour monitor would probably cost more than the Electron itself. However, the quality of the display is enough to justify the use of a monitor, being slightly restricted by the performance of even a good television set.

Incidentally, the TV lead is supplied, the other leads are not. The cassette lead required is exactly like that used by the BBC computer, motor control being available if the recorder can use it.

At the back of the unit, protected in a recess and by a slip-on plastic cover, is the remaining connector, a 50-way double-sided edge connector formed by an extension of the main printed circuit board. This carries all address and data lines and the principal CPU control lines, but no details of the pin-outs were found in the manual. An interesting and useful provision was a pair of threaded inserts bonded into the case on either side of the connector. By allowing extension equipment to be secured firmly, these would ensure against uncertain connections.

The remaining contents of the box were an introductory tape and two manuals, one an introduction to BASIC. The tape contained good and bad items, ending with a close

approximation to the 'Animation' program published in *Computing Today* for December 1982. The main manual was reasonably comprehensive, but unfortunately lacked a subject index, which is a pity, since there are 290 pages to search for a particular item. There was even a section on assembler programming, with a list of 6502 instructions.

THE KEYBOARD

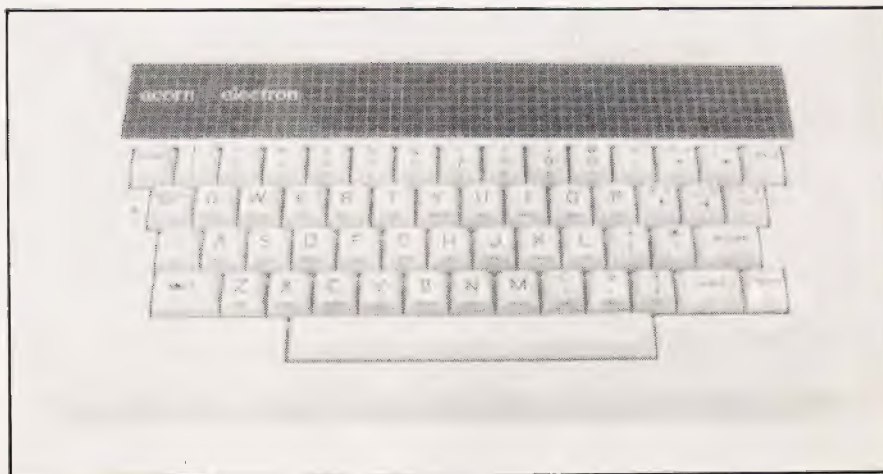
Since it is the main interface with the user, the quality of a keyboard can have a considerable influence on the value of a machine. The Electron keyboard produced few complaints. The 54 keys, arranged mainly in a standard QWERTY layout, were as good as any yet seen in respect of touch: if anything a little light and over-ready to respond. There was the usual rattle in fast action, perhaps preferable to a 'beep' as an indication that a key had been pressed.

Most of the character keys have three meanings choice of a particular meaning depending on the use of the Shift, Control and Function keys. This provides for 94 characters, for function keys, and 29 keywords, plus the four arrow keys and Copy for editing. Single-function keys are Break, Escape, Delete, Return, the two Shift keys, Control and Function.

In this way, a four-row keyboard is given something near the maximum number of characters and functions which it could contain. The only problem arising from that is the closeness of the editing keys and Break, which caused occasional embarrassment. However, since Function/O gives OLD with Return, recovery was simple, that combination restoring the less desirable effect of Break.

FIRST TESTS

The tape recorder still contained a BBC tape, and the temptation was



too much. Would the Electron load such a tape? It did, and the fairly simple programs on the tape were executed almost as on the BBC machine, though at a noticeably reduced speed and with a few differences.

This allowed a number of familiar programs to be run, which made it clear that the principal difference was the lower running speed, confirmed by the Bench Marks, as shown in the tabulation.

It was also noticed that graphic displays were clearer and sharper than they had been on the older machine, to the degree that vertical lines were noticeably thinner than horizontal lines — no doubt an effect of the reduced bandwidth of the TV receiver.

It was time to dig a little deeper.

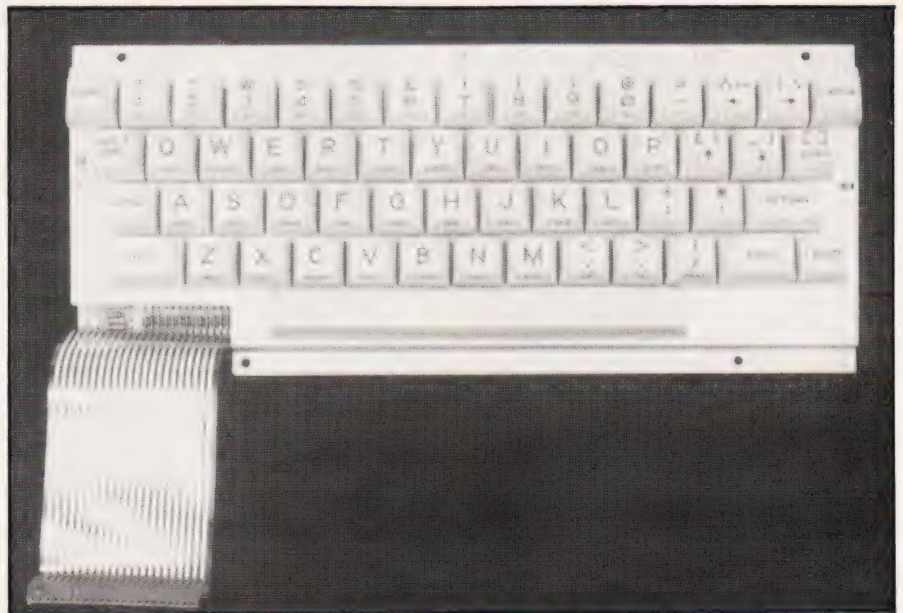
THE INSIDE STORY

You've seen someone poking into a newly-opened envelope looking for something they had expected to find there? Looking inside the Electron produced the same sort of reaction. To the right hand side of the box there was a small power supply unit producing 5 V, apparently on a switched-mode basis. Then there was another printed circuit board measuring about 9½" × 5", which carried 18 integrated circuits. And that was the lot.

Perhaps there was no real reason for surprise. After all, the ZX81 manages with only four main components, but this was a rather more versatile machine, with 32K of store carried internally. Where was it?

BENCHMARK TIME

BM1	BM2	BM3	BM4	BM5	BM6	BM7	BM8	Average
16	8.1	18.1	24.3	25.4	36.9	57.3	153.2	40.6



The answer was another surprise. There were four 4164 RAMs, each providing 64K x 1 bit storage. The lack of speed was immediately explained, because each byte access would need two accesses to the RAM, each picking up or depositing one nibble.

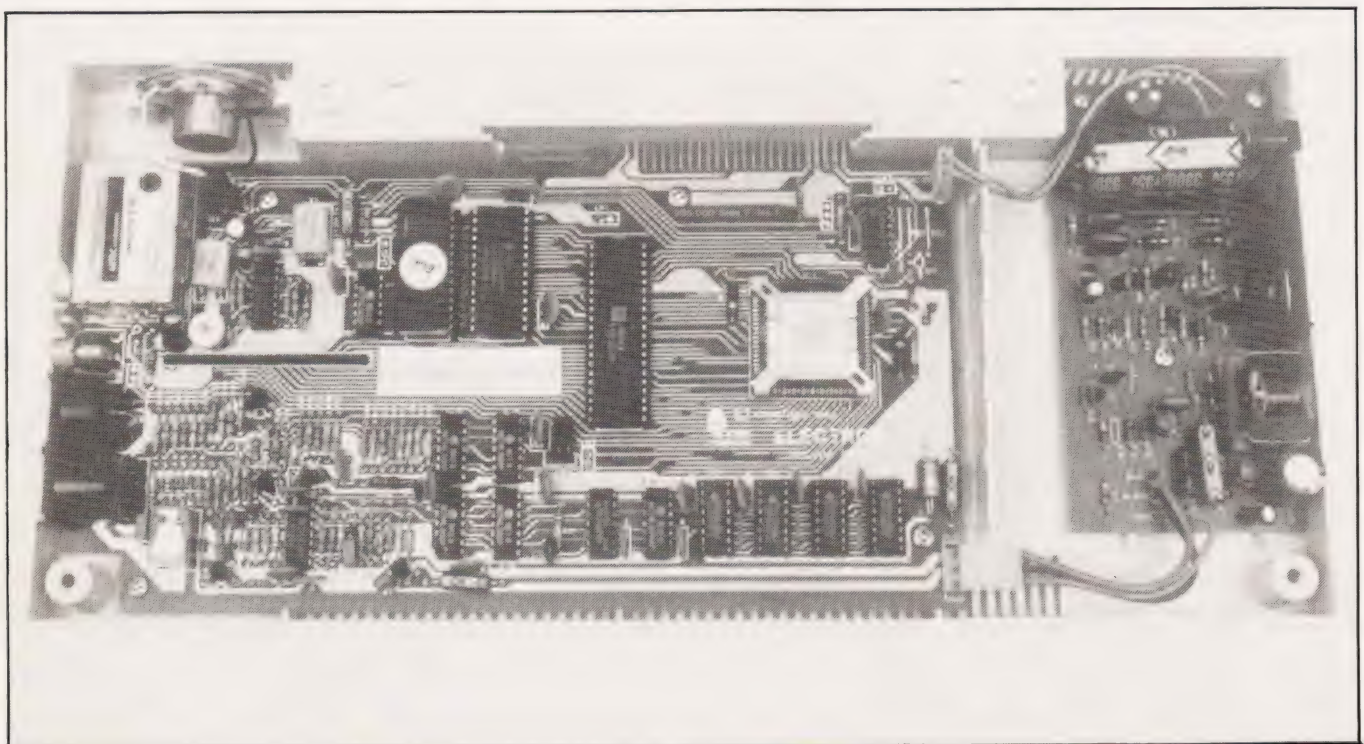
Further investigation identified nine ICs of small or medium scale integration types, the processor, two 16K ROM chips, an LM324 in the sound system, and one impressive 64-pin component of the type that sits in a square socket. This last item must be kept very busy, as it must handle keyboard and display trans-

sactions, cassette operations, and the clock, the graphics.

It is understood that even this is not the end of the story, as more components may yet be combined to reduce the chip count further.

FIRMWARE

The operating system identified itself as being of issue 1.00, and a quick scan through some of the routines revealed the expected similarity to the BBC operating system 1.20, even to the odd little quirk which omits the first byte of each page when clearing RAM dur-





ing initialisation. This preserves the Return from Interrupt that is set in &0D00 as the response to a non-maskable interrupt. It seems a pity that a tidier solution was not possible.

The data area from C000 upwards was a little smaller, but the overall 16K of operating system RAM seemed quite fully occupied, so it is possible that some hardware functions have been replaced by software, though it was not possible to check this.

The BASIC system also resembles that of the earlier machine, but with some functions omitted or modified.

Once again, pedigree counts, for here is a firmware system which has been developed progressively over a long period. It is not without fault, but the more serious bugs have been eliminated, and no evidence of significant problems was found during the tests.

THE BASIC

The Acorn version of BASIC is comprehensive in scope, and is broadly compatible with the Microsoft version except in respect of special extensions. If it has a fault, it lies in the need to set up long and complex strings of parameters, this being especially annoying when some of the parameters have no meaning, being 'reserved for future expansion'. However, if you want versatility, this is an inevitable consequence, since multiple options means multiple parameters.

The usual repertoire of familiar words and functions is offered, some

doing more than the manual specifies. For example, AND can be used on a bit-by-bit basis, as well as for combining logic conditions, but only the latter use was mentioned. Useful tools include AUTO, RENUMBER and TRACE, while LISTO offers various listing formats. It is unfortunate that AUTO provides a space after the line number during line entry, but enters no space in the stored line, which led to a need for some patient editing to tidy up listings, but the fact that so minor a point was noticeable speaks volumes for the satisfactory nature of the system as a whole.

Some words may wrinkle a few brows. ADVAL, for example, makes sense as a means of reading the analogue-digital converter value on the BBC computer, but its function here is to report on the state of the sound channel buffers.

Perhaps the most obvious omission from the normal BASIC vocabulary is CONTINUE. Once a

program has been stopped, it can be restarted by a GOTO with a carefully-chosen line number, but that is not quite the same thing.

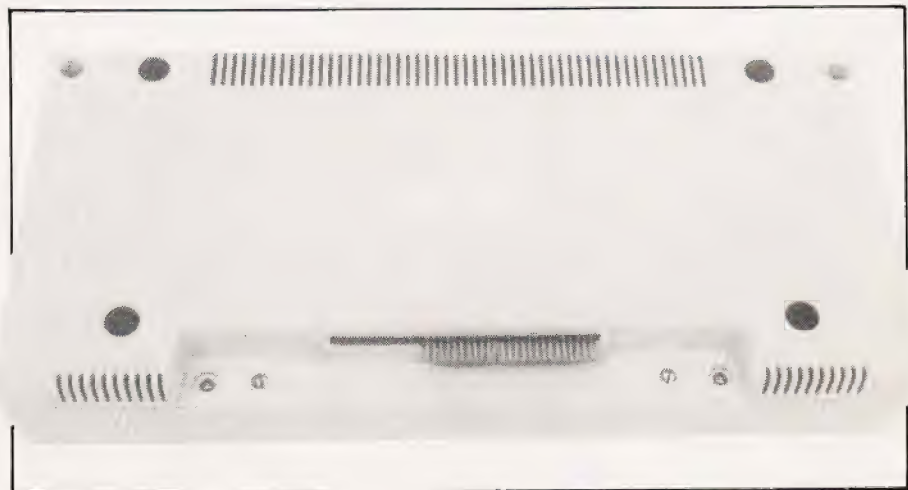
The most obvious added provision is the Assembler function, which is given particular attention in the Electron manual. The complete listing of 6502 instructions must be unique in any manual for a small computer. The facilities include some not specified for the BBC machine, and these allow a byte, word, double word or string to be set up. Some addressing modes, however, are simplified to match the Assembler characteristics.

GRAPHICS AND COLOUR

The Electron offers seven working modes, the teletext mode being omitted (it would need about five extra chips to be implemented). The remaining modes offer a wide choice of compromises between display complexity and space for programs, with 20, 40 or 80 column text on 25 or 32 lines, three levels of graphics definition, and 2, 4 or 16 colours. It is perhaps a pity that the corresponding data on available store space is not coupled with the specification of modes, but that has been corrected by the table provided here.

One point is clear. Without the very economical teletext mode, the maximum program space is less than the maximum available in the BBC machine. A thoughtless attempt to load 'Planetfall' resulted in the program beginning to appear on the screen when available space was exceeded, an interesting but not very useful effect. However, 20K is available in mode 6, which should be ample for most purposes. The 8K-odd left by modes 0-2 is more restricting.

The limitation is important, because it means that the most versatile colour/graphics combinations are only available for use with the



shorter programs.

Apart from the simplified MOVE and DRAW commands, there is a full repertoire of PLOT variants, 64 in all, and these include some fill functions not listed in the BBC manual. (They do work on the BBC machine, though! Try 72-79, which fill laterally.)

One exercise successfully carried through was the creation of a 'mimic diagram' for a model railway layout. The form of the diagram was specified by 56 sets of five parameters, some sets defining straight stretches and some defining curved segments. The trains were shown by colour contrast. Not surprisingly, the program was quite sizeable, with many lines of more than 80 characters, but it was stored in a sufficiently economical way to be compatible with mode 2.

It is truism to say that the capacity of the colour/graphics system is limited only by the user's imagination. One of the items on the demo tape was a picture of an island, complete with palm tree, and the surrounding sea was represented by moving waves...

SOUND

The sound system of the Electron was a trifle limited. Yes, there were three simultaneously available tone channels and a noise channel, but there were only two dynamic levels, on and off. There was an ENVELOPE command, so named for the sake of compatibility, but while it produced frequency modulation it had no effect on the sound envelope. The relevant parameters had to be set up, as zeroes, but they had no practical meaning.

Coupling these points with the use of a tiny internal loudspeaker

Mode	Graphics	Colours	Text	Program store
0	640×256	2	80×32	&21F0=8688 bytes
1	320×256	4	40×32	&21F0=8688 bytes
2	160×256	16	20×32	&21F0=8688 bytes
3	—	2	80×25	&31F0=12784 bytes
4	320×256	2	40×32	&49F0=18928 bytes
5	160×256	4	20×32	&49F0=18928 bytes
6	—	2	40×25	&51F0=20976 bytes

Table 1. Summary of Mode Characteristics

and a slight uncertainty in some of the musical pitches, the sound system had to be regarded as a gimmick rather than as something which could be used seriously. It will make 'space ship noises', but only the tone deaf would accept its music. However, perhaps better systems have encouraged an expectation of better performance. Frankly, one machine which worked through the television set loudspeaker was so much better in a number of respects that it has set a subconscious standard that most other machines fail to attain.

COMPARISONS

Odious though they may be, comparisons between the Electron and its forebears are both inevitable and necessary, if only to judge how the machines stand in relation to each other.

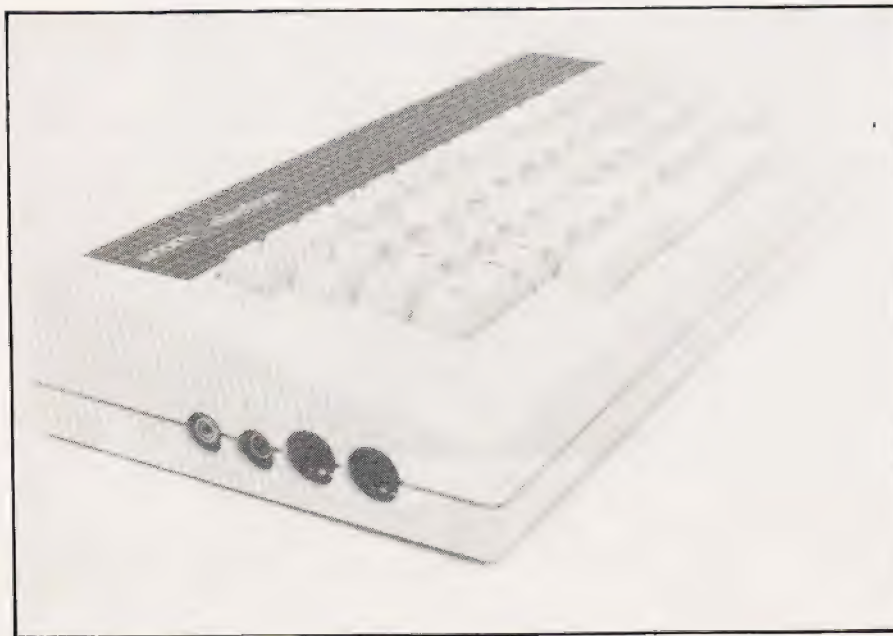
The Electron is a cut-down version of the BBC B machine, implemented with great hardware economy at the cost of some loss of operating speed and fringe facilities. It has twice the store of the A machine, but lacks the economical teletext mode, which would make a further 7K of store available in relation to mode 6. It

cannot be expanded to B model standard as the A model can.

The key question is going to be the cost and capability of the extension system. In its basic form, the Electron is a completely viable machine, up to a point, but it lacks the wherewithal to drive a printer or to communicate with external devices directly. There are clear indications that it is seen as a stepping stone to the BBC machine. Users are urged to write their programs so that they are compatible with the more complex computer, which makes sense if there is a later transfer to the larger device. The possibility of exchanging programs between the different machines, subject to some limitations, is an interesting feature in itself. (Incidentally, no problems arose in loading programs saved on one machine and read into the other, but the Electron seemed to be slightly more reluctant to read its own output until the precisely correct volume level was found!)

In its general price bracket, the Electron has no competitors (yet — Ed.) It is a fully developed machine, which — unlike several other types — worked perfectly from first switch-on. It has an impressive performance, with virtually no evident shortcomings. Its pedigree is an added recommendation. From a purely personal point of view, there was a tinge of regret that it used the 6502, rather than the Z80, because the simpler processor tends to need rather more complex routines and to suffer some limitations: but the 6502 has its staunch adherents, who no doubt will read these words with fury. It would certainly be more difficult to incorporate an Assembler for the Z80...

A key question regarding the merit of any computer is whether you would feel that you could recommend it to your friends. For many of the machines which have appeared during the past two years, it has been necessary to feel reservations. With the Electron, the only reservation in that its ultimate value must depend on the provision of extensions. For those who only want a minimum system, it seems almost ideal. It has already been recommended to several interested persons who come into that category.





"ONE THING YOU'LL NEVER GROW OUT OF"

When we tell you that the new Spectravideo SV-318 is incredibly expandable, we mean it. If you think that goes without saying, just glance through a few of our competitors' ads. Time and again, you'll read about 'a wide range of expansion modules now in the pipeline, 'coming next year' ... 'in the shops soon'.

The SV-318 has a full supporting system of 14 peripherals, available now. Which means that when you're ready to take the next step, so are we.

For software, too, the SV-318 is second to none: built-in CP/M compatibility gives you immediate access to over 3000 existing programs. And, using Microsoft BASIC as its resident interpreter, it's a home computer that gives you real scope for writing your own programs. Compact good looks and a host of intelligent design features (including a unique built-in Joystick/Cursor Control) may be no more than you'd expect from such a powerful and sophisticated machine.

But the price may well surprise you. At £199 (incl. VAT), the Spectravideo SV-318 is far better value for money than any of its 'disposable' competitors.

SPECTRAVIDEO

SV-318

PERSONAL COMPUTER

- **Memory** - 32K RAM expandable to an incredible 256K, and 32K ROM expandable to 96K.
- **Expandability** - Full supporting system of 14 peripherals, including game adapter, 7-slot expander unit, floppy disk drive, data cassette, etc.
- **CP/M Compatibility** - Immediate access to over 3000 existing software programs.
- **Graphics** - 16 colours, and 256 x 192 high resolution graphics.
- **Sound** - 3 sound channels, 8 octaves per channel.
- **71 Key QWERTY Keyboard** - special features include unique built-in Joystick/Cursor Control.

Microsoft BASIC is a trademark of Microsoft Corporation.
CP/M is a trademark of Digital Research, Inc.

For more information on the expandable SV-318, and the address of your nearest dealer, telephone or write to us at:

Name _____

Address _____

Tel. _____

CKSupplies

Unit 5, Norside, Oldmixon Crescent, Weston-super-Mare, Avon BS24 9AX.
Telephone (0934) 418838/516246

● This is an entirely new computer system. It was designed with both eyes fixed firmly on the future. So that whatever shape the future takes, we'll be able to fit it into the system. Just as simply as the peripherals and software already available fit into the system. That way, the system will grow with you. And you'll never get left behind.

● Based around the Z80A microprocessor, and utilising Microsoft™ BASIC, Aquarius™ has 8K ROM and 4K RAM resident within its console. It is able to provide up to 16 colours and resolution of 320x192, and generates its sound directly through the television's speakers.

● With twin cartridge ports, the mini-expander allows simultaneous use of additional RAM and software cartridges. Twin disc game hand controls are included and the unit provides two additional sound channels. The 16K RAM cartridge plugs into either the console or the mini-expander, increasing Aquarius™'s RAM capacity to 20K.

● With the ability to reproduce the entire graphic and character set of Aquarius™ at 80 characters a second, the printer's 40 column output allows transcription of the complete monitor image.



● Using standard audio cassettes, the data recorder provides storage for programs and information, and allows the use of cassette based software. Incorporating a digital tape counter and transmission indicator, it operates sequential searching.

● A large number of games, designed to take advantage of Aquarius™'s sophisticated colour and sound capabilities, are available on cartridges that plug into the console either direct, or through the mini-expander. Cassette based games can be used via the data-recorder.

● A wide range of preprogrammed cartridges is available, including the LOGO teaching program and practical home data systems like FILEFORM™ and the spreadsheet calculator package, FINFORM™.



AQUARIUS™
HOME COMPUTER SYSTEM

WITH AQUARIUS, YOU WON'T GET LEFT BEHIND.

MATTEL ELECTRONICS®



WHATEVER HAPPENS
IN THE FUTURE, IT'LL
FIT INTO THIS SPACE.

MATTEL ELECTRONICS®
AQUARIUS™

A. C. Ellis

NAMED FILES FOR NAS-SYS

Anyone who has used the Nascom 2 will know that, although the BASIC interpreter supplies a single character field for all its files, NAS-SYS does not. Consequently if you have a utilities tape with many object or machine code programs, all small and on the same tape, it is hard to get the right one. The usual process is to 'verify away' the unwanted files, counting as you go, then read the correct one. Wouldn't it be simple if you could tell NAS-SYS to find a specific file?

This is now possible using the program given here. The user is supplied with a 16 letter field in which to name the file. All characters within the field are used and even spaces are significant; thus the two file headers below are different:

```
( SPACE TEST )
(SPACE TEST )
```

If two files have the same file name then the monitor will load the first it sees.

There are two exceptions to this search for a specific file name. These are:

- (1) If the first character in the name field of the command is * it will read or verify the next file it comes to.
- (2) If during the search, a file with * as the first character in its name is encountered, it will be processed irrespective of what the monitor is looking for, so that:

```
VERIFY FILE (* )
```

will load the next file it comes to.
A program saved by

```
WRITE A FILE (* )
```

will be loaded come what may.

These commands offer a form of priority level to the files they are used on.

WRITING TO THE NAME FIELD

As already stated, the name field is 16 letters long. Any character may be written into it with the exception of control codes other than backspace and carriage return. These are used for editing and

field termination respectively. When the name field is full a CR will be inserted automatically.

The only other information needed is for the write command



Fig. 1 Format of the data blocks

and that is the start and finish addresses for the write command. The data needed is in Hex format, and it is entered under NAS-SYS. Any non-valid number (not 0-9 or A-F or greater than FFFF) will result in an error message and another prompt.

SEARCHING

During a search for either verify or read the message "Files encountered" will be displayed. Any header encountered will then be written up on the screen; if it is the one required you will see the

operation. Set the pointer associated with the new letter to the start of the read command in ROM (changing NAS-SYS command table and STAB).
(ii) Then modify the string output used by GENERATE (bring GENERATE into RAM and then modify) to use your new routine letter (say F) for the new READ, then change the string (original address, 004C hex onwards) to

```
GDS      DFEB      CR,"E","0,CR,"F,CR
GDSE     EQU E
```

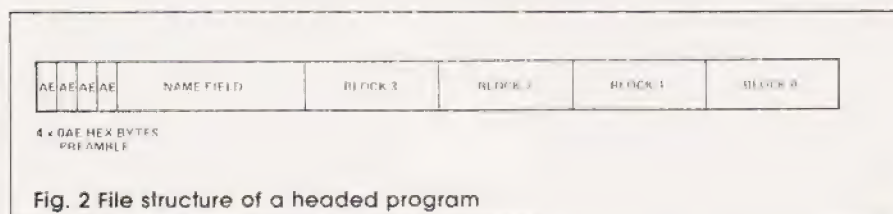


Fig. 2 File structure of a headed program

normal 'NAS-SYS type' load commence.

If you wish to terminate the search before completion, turn off the tape and enter four escapes. That will return you to NAS-SYS command level.

As with the normal commands both the serial port and the keyboard are scanned, so avoid typing during tape operations as this will cause errors.

Named files may be read by unmodified commands, but not the other way around. This is because the program will be looking for a header before the data is read. with no header, it won't look for the data.

(iii) Remember that ARGX will have F instead of R so alter accordingly, otherwise the best you will get is a verify.

Although I have not made this modification outlined, I see no reason why it should not work.

USAGE

Since BASIC has its own file handling routine, using the new routines would only make things hang up. But using them in ZEAP is fine. In fact, since you have 16 letters to use, it is easy to store a program name and indicate whether it is source or object code.

For those with an assembler, it is possible to relocate the program

by altering the ORG statement to a high area in RAM. This will allow it to be used as a utilities handler. Have it placed on a tape, as the first file, by the GENERATE command (since it has not yet been loaded, GENERATE has not been removed). Then follow it with all your utilities in the headed format.

The program is moved to high RAM because many utilities programs use the space that it occupied (0C80-0FC0 hex) when being used as a simple addition to the monitor.

Care should be taken if you save this program under its own operation. If you save the workspace, phantom headers may appear because of the way the program works. This is because the file will have its own header plus a valid header in the workspace.

HOW IT WORKS

Data is in 256 byte blocks, although the last block may have

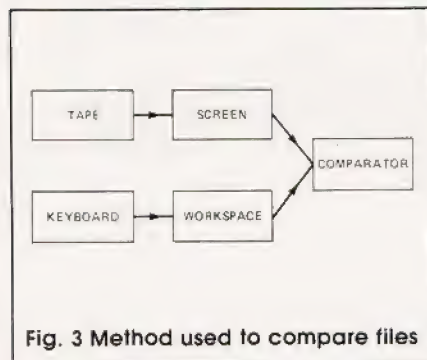


Fig. 3 Method used to compare files

less than that. The format of each block is shown in Fig. 1. All programs are output in a series of blocks, format as above, but the file structure of a headed program is shown in Fig. 2.

On loading the program in from tape type E 0DOC — this will alter the command table and set the new routines in NAS-SYS: if all is well it will return with the NAS-SYS-1 prompt. The programs themselves are more of a prefix to

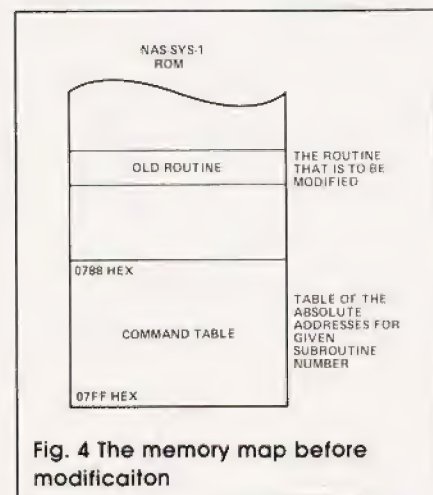


Fig. 4 The memory map before modification

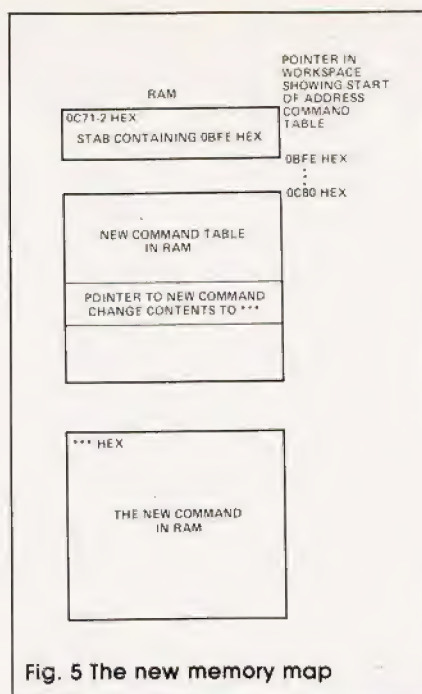


Fig. 5 The new memory map

the normal commands as opposed to a modification of them. Between the comments on the listing and the flowcharts all should be self-explanatory, but I have mentioned any points of interest below.

WRITE The SCAL 05D (one second delay) is to allow the tape drive to get up to speed. Since this has been done in the new addition to the program, we can re-enter the old routine past its own delay.

VERIFY and READ The comparison of required file to encountered files has been done as shown in Fig. 3, since it is easier to compare block for block than as it comes off the tape.

From the flowcharts it is not clear how NAS-SYS knows which is READ and which is VERIFY. It is done by loading the last command letter into ARGX before the routine is called, and then testing if ARGX contains the letter R.

NAS-SYS-1 treats its subroutines and commands much alike: for instance, if you enter values in the HL and DE registers and then SCAL 041 hex (DF 41) in a program, this is the same as using the arithmetic routine

A xxxx yyyy

People who use the Z80 CPU will recognise the instruction DF as RST 018 hex. The next byte in the program is the number of a particular command or subroutine within NAS-SYS (41 hex is ASCII A which means Arithmetic). To get the absolute address of the start of the routine, NAS-SYS uses a subroutine table.

So if we alter the values of the address in this table we can write

our own routines. The only problem is that this table sits deep in the NAS-SYS-1 ROM (0788 to 07FF) so it cannot be altered.

The answer to our problem is in the fact that NAS-SYS holds a pointer to the start of the table in workspace RAM (0C71-0C72) called STAB. So if we alter STAB to point to the start of our new subroutine/command table in RAM then NAS-SYS will use this table instead of its ROM-based one.

There is one further step: since the table starts with the commands, the commands start with Arithmetic, and the table is ASCII-associated it will start at (STAB) + 2 * 041 hex bytes.

The displacement of 82 hex bytes is to allow for the 41 hex address not being used.

To save space the table starts at 0C80 hex so the pointer is at 082 hex less than this (ie 0BFE). Since no access to the table is made below 'A' ASCII there is no risk of a false address being created by taking a value from NAS-SYS workspace.

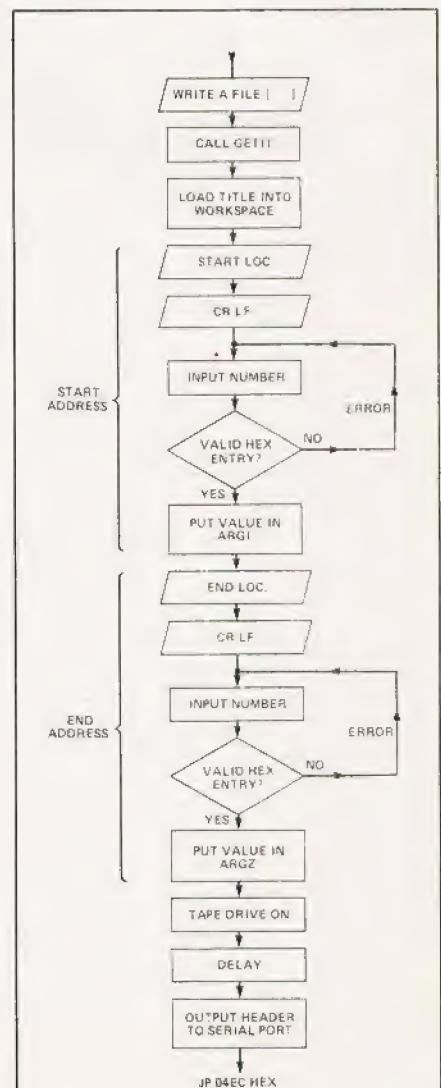


Fig. 6 The WRITE command flowchart

So now we have a copy of the command table in RAM, and the pointer is set to the start of it. Thus any alteration of the absolute address in the table is all that is needed to modify NAS-SYS-1 commands or subroutines, or even add commands to the ones available. I say add as the monitor commands D,F,P and Y do not exist, their table addresses pointing to ERRM (Error message). By altering these addresses the commands may be used to suit your own needs, for example debug routines and so on.

The only restraint that is placed upon the new subroutines is that they must obey the same functions and preserve the same registers as the routine that was replaced (since the monitor uses the same subroutines for its own operation).

Remember that on reset NAS-SYS re-initialises part of its workspace, STAB included. So any

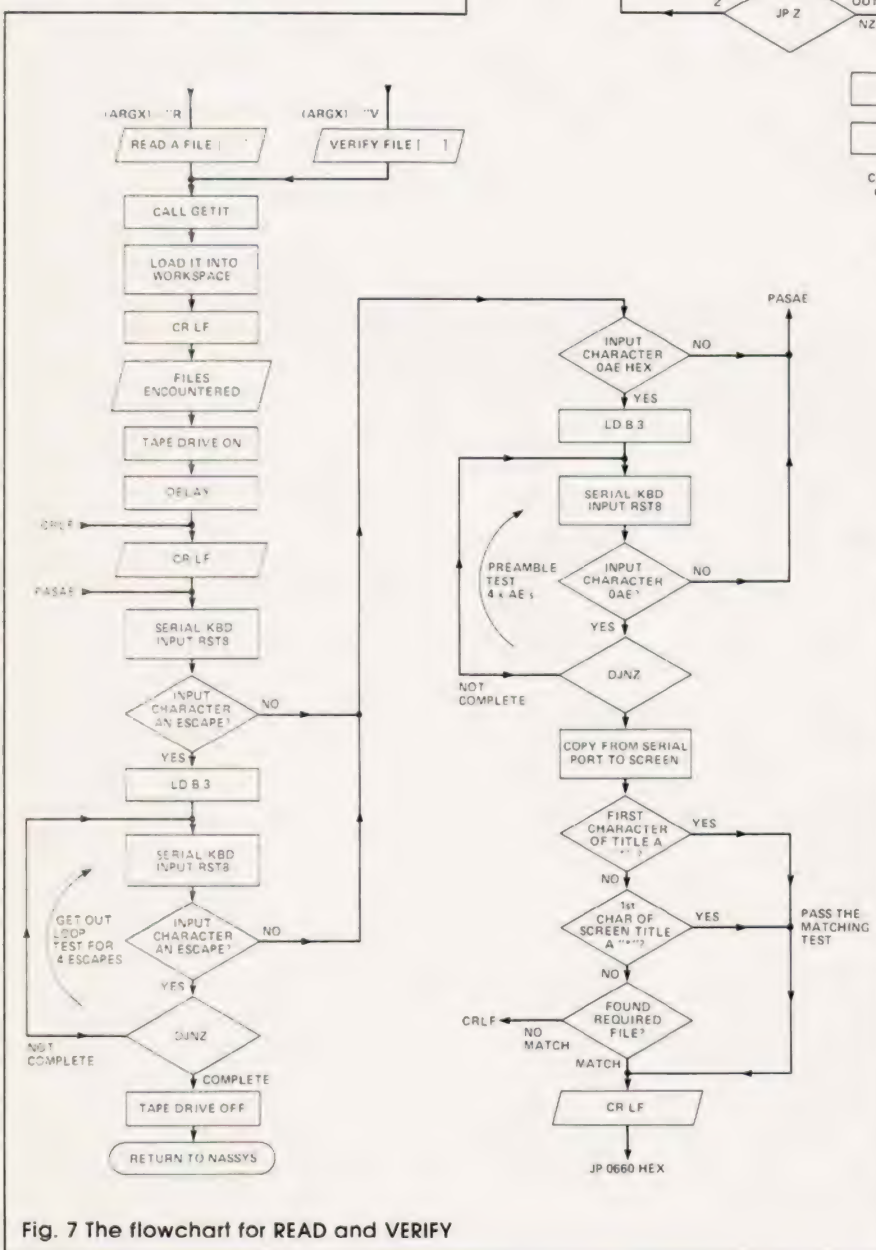


Fig. 7 The flowchart for READ and VERIFY

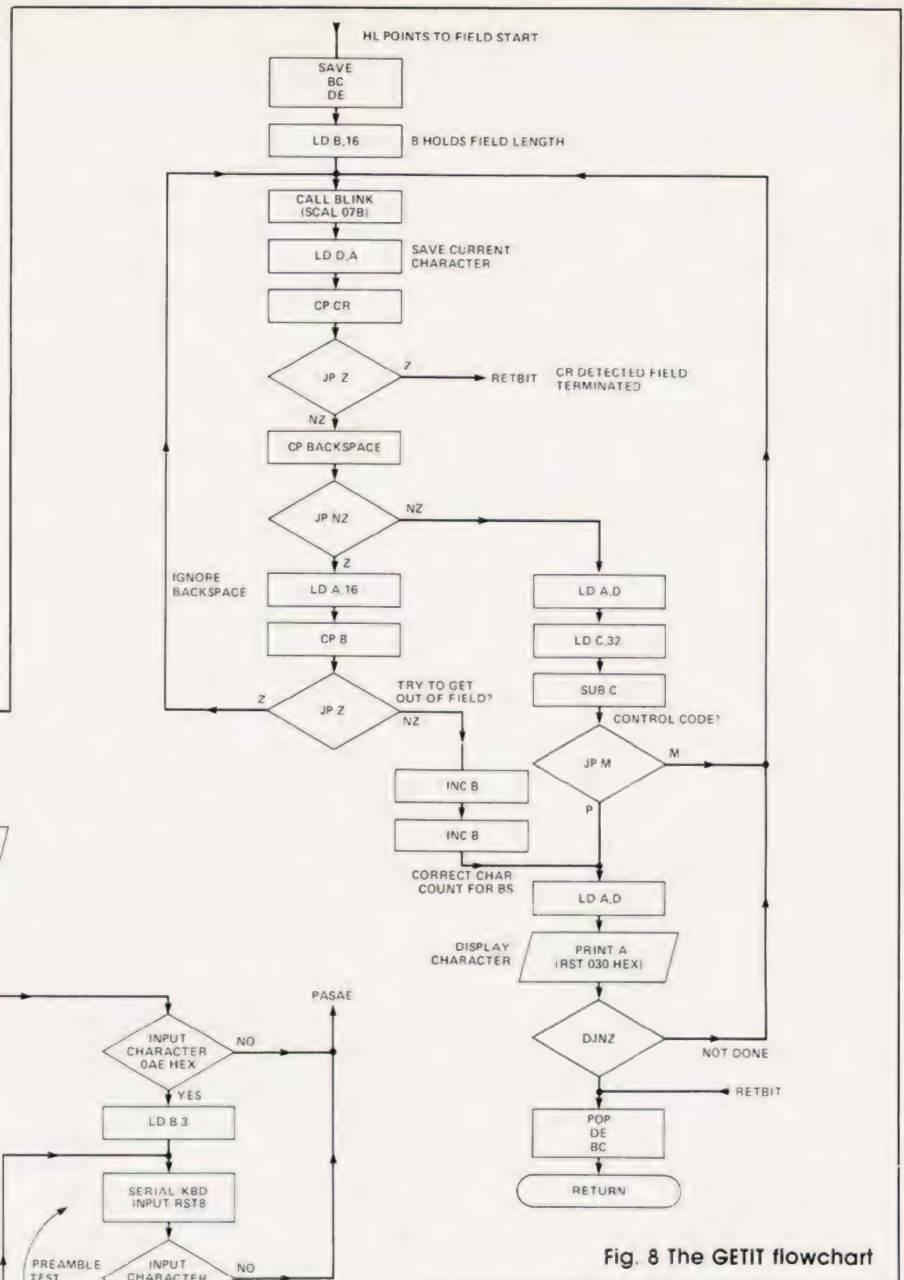


Fig. 8 The GETIT flowchart

modification will be made ineffective until you run the program to change STAB again.

In general any modification to NAS-SYS will only be in a part of a subroutine or command, so if possible jump to the old routine at the relevant place after the modification. This will save you time and space by avoiding duplication.

Some modifications will not appear to work when in NAS-SYS (changing INLIN). This is because the monitor program does not call them from the table but runs into them from another routine.

When debugging a new modification remember that the B command will only work on a program under execution, and that your routine is a part of the monitor. So you will have to carefully set your breakpoint and then execute your routine.

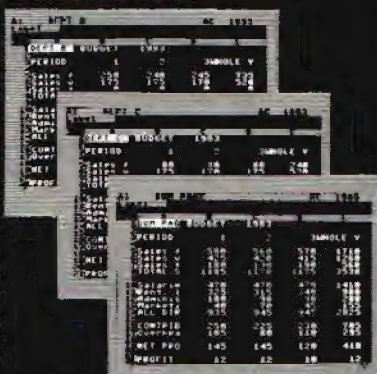
CalcResult

Three Dimensional Spreadsheet that turns your Commodore 64 into a powerful business computer

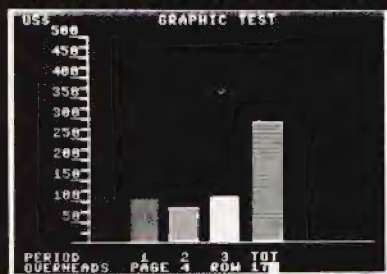
Only CalcResult gives you all these exciting features . . .

● THREE DIMENSIONAL CALCULATION

CalcResult's powerful three dimensional spreadsheet format rapidly becomes an irreplaceable tool for those involved in figure manipulation. Budgets reports, statements, forecasts and planning are all areas in which a saving in time and resources are as important as the ability to handle all forms of calculations. The many features of CalcResult simplify the rapid production and calculation of all aspects of business forecasting and planning. Each model can have up to 32 pages of associated information with a consolidated report and every page has 63 x 254 data positions which can contain text, formulas or values. CalcResult's powerful editing functions mean rapid creation and amendment of models and, once created, split screens and multiple page viewing allow easy review of information.



● GRAPHIC REPRESENTATION



CalcResult can translate rows of columns of numbers into histograms on the screen or printed histograms can be used to enhance presentation of tabular information in reports. (With CalcResult 64 full colour options are available on the screen.)

● HELP FUNCTION AND AN EXPLICIT MANUAL

CalcResult is simple to use and easy to learn thanks to a detailed instruction manual and help screens that are available at the touch of a button, to explain the functions available for each command.

● FLEXIBLE PRINTING

CalcResult allows you to define your own report layout. You can choose the order of columns to be printed and set the width of each independently. Layout definitions can be stored on a disk for future use.

● TIME SAVING COMMANDS AND CONDITIONAL FUNCTIONS

Commands like replicate, copy, move, go to, insert and delete make CalcResult simple and easy to use. CalcResult calculates according to correct mathematical priority and has standard functions for statistics, trigonometry and logarithms. Conditional functions like IF THEN ELSE and OR AND NOT allow greater flexibility in the setting up of models. Once created, all formulas are protected from accidental deletion.

CalcResult will only operate in conjunction with Commodore 64, a Commodore 1541 disk drive, and a Commodore serial printer.

PRICE: CalcResult 64 £109.00 (plus VAT)

CalcResult is distributed solely in the UK by Kobra Micro Marketing. For details of your nearest stockist of CalcResult phone (0491) 572512 or fill in the coupon below.

KOBRA

MICRO MARKETING

P.O. Box 28,
Henley-on-Thames, Oxon.
Telephone
(0491) 572512



To: Kobra Micro Marketing, P.O. Box 28, Henley-on-Thames, Oxon.
Please send details of the exciting CalcResult program

Name: _____

Position: _____

Address: _____

Tel. No. _____



handic
software ab

- a company in the Datatronic group -



A STEP BEYOND THE ARCADE...



Demon Knight · The Valley · Strategy 1—Invasion · Strategy 2—Bismark
White Barrows · Detective · Cells & Serpents · Stockmarket
Conquering Everest · Cloneit/Renumber · Gallery of Death · Planetfall

HORNSBY



ASP SOFTWARE
145 Charing Cross Rd, London WC2H 0EE
Tel: 01-437 1002

Now available from:

Telford Electronics
 Inside Bambers
 Telford Town Centre
 Shropshire

John W Bagnall Ltd
 18 Salter St
 Stafford ST16 2JU

Mega Ltd
 7 Anley St
 St Helier
 Jersey

Computer Cabin
 24 The Parade
 Silverdale
 Newcastle
 Staffs

Software City
 3 Lichfield Passage
 Wolverhampton
 W Midlands

D A Computers Ltd
 104 London Rd
 Leicester LE2 0Q2

Fal Soft Computers
 8 St Georges Arcade
 Falmouth
 Cornwall TR11 3DH

Statacom Ltd
 234 High St
 Sutton
 Surrey

William Smith (Booksellers) Ltd
 University Bookshop
 White Knights
 Reading RG6 2AH

The Car Shop
 103 Lower Lickhill Road
 Stourport

Canterbury Software Centre
 9 The Friars
 Canterbury
 Kent CT1 2AS

JCV Organisation Ltd
 Units 7/8
 Wharf St
 Warwick
 CV34 5FO

3D Computers Ltd
 230 Tolmouth Rise South
 Surbiton
 Surrey

Vision Store
 96-98 North End
 Croydon CR0 1UD

Philip Copley Hi-Fi Ltd
 6 Wisley Street
 Clifford Court
 Ossett
 Wakefield
 N Yorks

Micro North
 7 Broad Street
 Bury
 Lancs

4-Mat Computing
 67 Friargate
 Preston
 Lancs

Channel 8 Software Ltd
 51 Fishergate
 Preston
 Lancs

Windsor Computer Centre
 Thames Avenue
 Windsor
 Berks

Rush Hi-Fi & Video
 5-6 Cornhill
 Chelmsford
 Essex

Amersham Computers
 18 Woodside Rd
 Amersham
 Bucks

Godfreys
 30 East Walk
 Basildon
 Essex

Estuary Software Products
 261 Victoria Avenue
 Southend on Sea
 Essex

Software Centre
 128 Wigmore St W1

Dimension
 27/29 High St
 Leicester

Vic Oddens
 5 London Bridge Walk
 London SE1

Computer Plus
 2 Church Lane
 Banbury
 Oxon

K P Cameron & Computer Shop
 12a Kings Parade
 Cambridge

Gemini Electronics
 50 Newton St
 Manchester

Sherwoods Photographic Ltd
 11-13 Gt Western Arcade
 Birmingham B2 5HU

Brainwave Micros Ltd
 24 Crown St
 Ipswich
 Suffolk IP1 2LD

Micro Business Centre Ltd
 17-19 Lichfield St
 Wolverhampton WV1 1EA

Trend & Hi-Fi Video
 167 High St
 Walthamstow
 London E17 9PD

Eddy's (Nottm) Ltd
 ENL Audio Visual
 116-118 Alferton Rd
 Nottingham NG7 3NR

Cannock Computer Systems Ltd
 18 Old Penkridge Rd
 Cannock
 Staffs WS1M2

G Foster
 CB TV Hi-Fi & Video
 Sales & Service
 59 Tamworth St
 Lichfield
 Staffs

CAMBRIDGE LEARNING

SELF-INSTRUCTION COURSES



GSC
SUPERKIT
£19.90

Learn the wonders of digital electronics!

This practical kit for beginners comes complete with an instruction manual, components, and

EXP300 breadboard to teach you all the basics of digital electronics. The course needs no soldering iron; the only extra you need to buy is a 4½V battery.

Using the same board you can construct literally millions of different circuits.

The course teaches boolean logic, gating, R-S and J-K flipflops, shift registers, ripple counters, and half-adders.

It is supported by our theory courses

DIGITAL COMPUTER LOGIC
£7.00

which covers: basic computer logic; logical circuit elements; the design of circuits to carry out logical functions; flipflops and registers; and

DIGITAL COMPUTER DESIGN
£9.50

Our latest, most up-to-date course on the design of digital computers, both from their individual logic elements and from integrated circuits. You are first shown the way in which simple logic circuits operate and then, through a series of exercises, arrive at a design for a working machine.

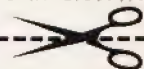
Other courses available include:

MICROPROCESSORS & MICROELECTRONICS @ £6.50
COMPUTER PROGRAMMING IN BASIC @ £11.50

GUARANTEE No risk to you. If you are not completely satisfied, your money will be refunded upon return of the item in good condition within 28 days of receipt.

CAMBRIDGE LEARNING LIMITED, Unit 54 RIVERMILL SITE, FREEPOST, ST IVES, CAMBS, PE17 4BR, ENGLAND.
 TELEPHONE: ST IVES 0480 67446. VAT No 313026022

All prices include worldwide postage (airmail is extra - please ask for prepayment invoice). Give A/c No 2789159. Please allow 28 days for delivery in UK.



.....SUPERKIT(S) @ £19.90
DIGITAL COMPUTER DESIGN(S) @ £9.50
DIGITAL COMPUTER LOGIC @ £7.00

(I enclose a cheque/P.O. payable to Cambridge Learning Ltd for (Delete where applicable))

Please charge my:

Amex American Express Barclaycard Diners Club
 Eurocard Visa / Mastercard / Trustcard

Exp. Date Credit Card No

Signature

Telephone orders from card holders accepted on 0480 67446
 Overseas customers (including Eire) should send a bank draft or sterling drawn on a London bank, or quote credit card number.

Name

Address

.....

.....

Cambridge Learning Limited, Unit 54 Rivermill Site, FREEPOST, St Ives, Huntingdon, Cambs, PE17 4BR, England. (Registered in England No 1328762).

Don Thomasson

PROBLEM PAGE

Our sixth and final article in this series answers our poser from last month about the magic square and shows how squares of larger size may be tackled.

The program offered in this final part of the series will allow 4-by-4-sized magic squares to be worked out, and can easily be modified for the 5-by-5 variety. Before looking at it in detail, however, it will be useful to consider the relatively trivial 3-by-3 case, where the numbers 1 to 9 have to be arranged so that each line, column and major diagonal adds up to 15.

This total can be made up in just eight ways, all of which will be used in the diagram:

1+5+9
1+6+8
2+4+9
2+5+8
2+6+7
3+4+8
3+5+7
4+5+6

The number in the centre is part of a column, a row, and two diagonals. It must therefore appear in four combinations, and must therefore be 5. Numbers in the corners are part of a row, a column and one diagonal. They must appear three times, and must therefore be 2, 4, 6 and 8. On this basis, a possible square is;

2 9 4
7 5 3
6 1 8

All other possible arrangements are rotations or reflections of this.

Determination of viable arrangements for larger squares is more complicated, and there are many more possibilities, but the general principle is that the viable combinations for each line are worked out, and the possible values for a given square can then be found by collating the values for the lines which pass through the square. The program uses five arrays:

A* contains the given data, fed in by the user.

B starts as a copy of A, but adds deduced entries.

C identifies unused numbers by zeroes.

D holds the viable numbers for lines.

E holds viable numbers for squares.

Subroutine 1000 clears A and B, and subroutine 4000 displays an empty grid, from the contents of array B. Subroutine 1200 then allows the input of given data, a zero number erasing an existing entry. A zero row number gives an exit to the next stage, which copies the data into array B and sets up the used numbers in array C (subroutine 1300). The display of array B contents is refreshed.

An opportunity is then given to return to subroutine 1200 to make any changes. Otherwise, subroutine 3500 clears arrays D and E, and subroutine 2000 analyses the situation. This takes some time in the early stages, and those who are impatient may like to insert a line 2725 to print out the viable combinations of A, B, C and D. TOTAL may be printed out as well, and the addition of L will show which line is being handled: the rows are numbered 1 to 4, the columns 5 to 8, and the diagonals are 9 and 10. The amount of work being done may come as a

surprise.

When subroutine 2000 has set up array D, subroutine 1400 collates the lines through each vacant square and puts the results in array E. The variable MIN registers the case offering the minimum number of alternatives, and if MIN=1 the only possible number is set in array B and displayed. If MIN=0, there is no solution, and that is reported. If MIN is more than one, there are options in all squares, and the case with minimum alternatives is reported.

The fact that a particular option is reported is no guarantee it will yield a viable solution. The numbers offered should be noted and tried one at a time, the routine returning to subroutine 1200 for that purpose if the answer to 'Any changes?' is Y or y. If no solution is then found, the next option should be tried.

Note that any numbers deduced earlier in the process are lost, since they may not be viable with the option in use.

If MIN=16, the square is complete, and the routine stops.

The program was originally written for a 5-by-5 matrix, and can be reconverted by altering the constants as follows: 4 to 5; 5 to 6; 9 to 11; 10 to 12 (not in lines 1250 and 4020); 8 to 15; 11 to 21; 15 to 24; 16 to 25; 34 to 65. For this adaptation, you may like to try the two squares in Fig. 1.

0	6	5	0	0
0	0	0	16	10
11	20	0	0	0
9	0	0	15	18
0	13	19	7	0

9	0	0	0	11
0	21	0	12	0
0	0	13	0	4
16	0	7	0	0
0	8	1	24	0

Fig. 1. Two 5-by-5 magic squares to solve using the modified program.

'NOW WIN THE POOLS'

THIS IS MEANT FOR YOU — ESPECIALLY IF YOU USE A SINCLAIR SPECTRUM COMPUTER
or even ANY COMPUTER — OR NO COMPUTER AT ALL.

HAVE YOU EVER HAD THAT DREAM OR EVER WISHED THAT YOU HAD "WON ON THE POOLS" —
AT LAST YOU CAN TURN IT INTO REALITY.

THERE IS A SECRET OF "HOW TO WIN ON THE FOOTBALL POOLS" — IT CAN BE DONE. I DISCOVERED THE SECRET
A LONG TIME AGO — NOW, FOR THE FIRST TIME I'M PREPARED TO SHARE IT WITH YOU.

HOW DOES THIS INTEREST YOU — I HAVE DOCUMENTARY EVIDENCE BY WAY OF POOLS WINNINGS DIVIDEND SLIPS/
CANCELLED CHEQUES, etc, SHOWING MY PRESENT WINS ON THE POOLS AS FOLLOWS:—

First Dividends	Second Dividends	Third Dividends	Fourth Dividends	Fifth Dividends	Sixth Dividends
765	1,818	2,942	1,952	631	93

A GRAND TOTAL OF 8,201 (EIGHT THOUSAND, TWO HUNDRED AND ONE DIVIDENDS — so far).

I HOLD THE UNCHALLENGED WORLD'S RECORD FOR POOLS WINS

Do not let anyone tell you that it is impossible to
"WIN ON THE POOLS" — since I perfected my
method, I HAVE WON REGULARLY for over
TWENTY-FIVE YEARS — proof that it is no
'flash-in-the-pan'.

I have CHALLENGED THE WORLD with my
record of wins and with all the evidence that I
possess — NO ONE has ever been able to accept the
Challenge — I KNOW NO ONE EVER WILL.

MY SECRET IS NOW PLACED ONTO COMPUTER CASSETTE FOR YOU.

THE METHOD IS THE GREATEST TREBLE
CHANCE WINNER IN THE HISTORY OF
FOOTBALL POOLS — IT WILL LAST
FOREVER — BOTH FOR ENGLISH AND
AUSTRALIAN FOOTBALL POOLS, WITH
EQUAL SUCCESS.

I now intend to give a limited number of people the
opportunity of making use of my method — perfected
over 25 years and proving itself on EVERY ONE
OF THOSE TWENTY-FIVE YEARS.

You will have noted details of my personal
achievements so far, as given to you above.

A GRAND TOTAL of 8,201, yes 8,201 POOLS
DIVIDENDS, including 765 FIRST DIVIDENDS.

My Pools Winnings Dividend slips now number so
many, that they fill a very large suitcase and will
stand as my evidence of all claims in ANY COURT
OF LAW IN THE WHOLE WORLD.

Taking just the past 25 years into consideration, I
have won ON AVERAGE over 328, (THREE
HUNDRED AND TWENTY-EIGHT) Pools
Dividends EVERY YEAR — or — AN AVERAGE
of over SIX DIVIDENDS EVERY WEEK for
TWENTY-FIVE YEARS.

You have my absolute Guarantee of the complete
authenticity of every claim, cheque, document, letter,
etc, contained herein.

Don't take my word for it, read what people write about me and my method:—

*I won on Zettors last weekend. It was not a big sum, but all the same it was a very nice
surprise for me.* J.C., Lancs.

*I appreciate the straightforward method you adopt, which is such a contrast to the
rubbish of misrepresentation which is so common in the Betting World, by unscrupulous
and self-opinionated charlatans.* C.H., Devon

Winnings cheque received today, sincere thanks. D.N., Devon

I congratulate you on your achievement. R.R., Wales

*I should like to thank you for a most exciting season and look forward to hearing from
you again.* J.C., Hants.

I would like to acknowledge cheque and say how much I appreciate your integrity.
J.M., Scotland

Many thanks for your system, it is all you say and more. J.C., Lancs.

*Your wonderful system won me £3,527. I intend to visit London soon and will be able to
come and see you personally.* (Overseas Client). P.M., Kampala.

*Many thanks for trying so hard to please us all, your brother should be thanked also.
One of our daughters, WHOSE HUSBAND YOU HELPED ENORMOUSLY,
has just phoned, the four of them have just spent a lovely holiday in Spain.*
K.R., Isle of Man.

I do have losing weeks, but ON AVERAGE my
winnings show over SIX DIVIDENDS EVERY
WEEK for the past 25 years.

I know that you are now utterly flabbergasted, it
always happens to everyone with whom I come into
contact. Please just sit back and imagine for a
moment my FIRST DIVIDEND wins alone — they
now number 765 (seven hundred and sixty-five) and
will probably be even more by the time this
advertisement appears in print.

I AM NUMBER ONE IN THE WORLD AND
NO ONE DISPUTES IT.

For as long as I continue to enter the Football Pools
my wins will continue. I have already said, they
apply, with equal success to both English and
Australian Football Seasons.

I intend to release a STRICTLY LIMITED
NUMBER of copies of my cassette — DO NOT
DELAY AND FIND YOU ARE TOO LATE, in
which case I would have to refund your money.

I am so confident of YOUR success that if do not
win at least THREE FIRST TREBLE CHANCE
DIVIDENDS in the first 20 weeks of entering, I will
completely cancel the balance of the purchase price
and you do not have to pay me another penny, at any
time, no matter how vast your winnings.

I only wish that space would allow me to give you
photographs of my winnings slips, cancelled cheques,
etc, but it is of course impossible — they now
number 8,201 dividends. I have however given JUST
A FEW EXTRACTS FROM ORIGINAL LETTERS
I hold from my small Clientele.

I am the Inventor and Sole Proprietor of my method,
Registered as EUREKA — ('I have found it'). I am
known as The Professor in Pools Circles — I am of
the Highest Rank in Forecasting — this is beyond
dispute. I am marketing a limited number of
Computer Cassettes, under my Registered Company
— FOOTBALL ENTERPRISES.

My initial charge for a copy was £75, but for this
SPECIAL REDUCED PRICE OFFER I will send
you a copy, for £20, (twenty pounds) ONLY,
plus your Promise to pay me the balance of £55
— ONLY IF YOU WIN AT LEAST THREE
FIRST TREBLE CHANCE DIVIDENDS IN
YOUR FIRST 20 WEEKS OF ENTERING —
otherwise you owe me NOTHING FURTHER.

This is surely proof absolute of my supreme and
utter confidence in my own abilities and in the
capabilities of my discovery. I could easily CHARGE
£2,000 per cassette on the evidence I possess, but
that would not be fair to everyone, which is what I
want to do.

My method is WORLD COPYWRIGHT, any
infringement and immediate proceedings will be
taken, without prior warning. It is truly ingenious
and has stood the test of time.

My cassette is simplicity itself to operate and you'll
be given FULL DETAILS for weekly calculating.
Your entry need not involve you in any large weekly
stakes, you can enter for as little as 25p, if you wish.

I charge NO COMMISSION on any of your wins —
no matter how BIG they may be.

I realised a long time ago, that it was no good sitting
down and dreaming about winning the pools, so I
burnt the candle at both ends, working late into the
night, occasionally RIGHT THROUGH THE
NIGHT, I KNEW there was a way, eventually it all
paid off and has been doing so ever since.

I am unable to vary my offer to anyone, so please do
not request it, as I shall very easily dispose of the
cassettes I have prepared and am making available.

IMMEDIATELY I perfected my method I
commenced winning right away, (first with just a
little £163, the first week I used it), I HAVE
NEVER LOOKED BACK SINCE, amongst all
those dividends was one for over EIGHT
THOUSAND POUNDS for just one eighth of a
penny stake.

I will release a copy on cassette, to you, on receipt of
the completed order form and your Signature
thereon, confirming you will treat it in the
STRICTEST CONFIDENCE between us and retain
it for your OWN USE ONLY.

PLEASE NOTE:

If you happen to be the proud owner of a Computer,
other than a Sinclair Spectrum, you can still
purchase a copy of my method, for the same
price and program it YOURSELF on to YOUR
OWN COMPUTER — or even if you do not
have a COMPUTER.

*I sent in my FIRST entry last week and won 2nd and 3rd dividends, as you will see
from the enclosed certificate. One more and I would have collected over £400 for FIRST
dividend. Once I've won a fair amount I shall be staking from winnings and at 2p per
line, A FIRST DIVIDEND last week at this would have been over £3,000.*
C.A., Yorks.

I am very interested indeed and enclose £20 herewith. I agree to pay you the
balance of £55 ONLY if I win at least THREE FIRST TREBLE CHANCE
DIVIDENDS in my first 20 weeks of entering — otherwise I owe you NOTHING
FURTHER at any time — no matter how much money I win. My Signature below
is my Undertaking to retain complete and absolute confidence about the method.

Name.....

Address.....

.....

.....

Signature

The Managing Director,
Football Enterprises,
'Anvon',
9 New Road,
Haverfordwest, Pembro.

Please tick if cassette is for:
Sinclair ZX81 (16K) ☐
Sinclair Spectrum (48K) ☐
Any other Computer ☐
No Computer at all ☐

H.M. Hoffman

ATARI DISC LIBRARY

If you've got an Atari, a disc drive, and lots of files on lots of discs, here's a utility program that will help you keep track of what's what and where.

VARIABLE	FUNCTION
NAMES	Disc number
DESS	Comments
AS	Filename
CS	Record read from disc
IS	User response
RECORDS	The whole data base
FILES	Data for one disc
CLS	Clear Screen character (125)
LD	Length of comment
NAME	Number of files read
PT	Pointer into FILES
ER	Error number
GC	ASCII code of key pressed

Table 1. Use of variables in the program.

This program has been written for Atari owners who possess one (or more) disc drives.

The program produces a cumulative catalogue of your disc files, complete with comments for each name to help you keep track of many files spread over several discs.

The menu options in the program are as follows:

1. Create library file (should it not exist already). A suitable warning is displayed should you attempt to make use of this option with an existing data file.

2. Read files. This option automatically reads the files off the disc currently in the drive. There is an opportunity to enter a two-character disc number, then a 20-character comment for each file. There is a command to enable

any file to be omitted from the database. Use is made of the multi-size and colour text, mixed modes.

When all the files are read from any disc, the data to be stored is displayed and the user is prompted to insert the data (library) disc, whereupon the new data is added to the database. This can be repeated for the other discs in your collection.

3 and 4. These options are self-explanatory, but 3 must be used before 4, although 4 can be repeated without having to re-load from disc. I have formatted the output to be suitable for 40 or 80 column printers, or just the screen. Use Control-1 to pause the display.

5 and 6. The last two options require no explanation.

The program uses different colour text for different options and

on an unexpected error the error number is displayed without breaking out of the program. Some points of interest are that location 710 holds the screen colour, while location 195 holds the error number. Note also that by entering PROGRAMS.E: the library can be viewed under DOS copy 'C'.

```

1A PROGRAMS      DATAFILE
1A DOS           SYS  COULD HAVE SKIPPED
1A DUF           SYS  AND THIS
1A AUTORUN       SYS  RUNS"D:\LIBRARY.BAS"
1A LIBRARY       BAS  THE LIBRARY PROGRAM
2A UTL1          CALENDER
2A UTL2          HEX DECIMAL CONVERT
2A UTL3          CREATE AUTORUN RUN
2A UTL4          CLOCK (60Hz)!!!
2A GAM2          MAZE CHASE
2A GAM3          DETECTIVE
2A GAM4          SUPER BARRICADE
2A DEM1          HELICOPTER DEMO
  
```

Fig. 1. Sample database printout.

Listing 1. Complete listing for the program Disc Library.

```

2 REM ATARI 400/800 DISK LIBRARY PROGRAM
3 REM 32K MINIMUM MEMORY
4 REM BY H.M.HOFFMAN
9 DIM NAME$(2),FILE$(36*50),DE$(21),A$(20),I$(1),C$(37)
10 DIM RECORD$(500*35):CLS=125:GRAPHICS 0
11 POKE 710,180:POKE 195,0
13 GOTO 380
14 ? CHR$(125):? "INSERT DISK TO BE CATALOGUED":?
15 ? "ENTER DISK NUMBER (2 CHARS MAX)":INPUT NAME$
26 FILE$=" ":FILE$(36*50)=" ":FILE$(2)=FILE$
28 NAME=0
30 CLOSE #1:OPEN #1,6,0,"D:*. *":REM DIRECTORY OPEN
32 PT=0
34 INPUT #1,A$
35 IF A$(5,13)="FREE SECT" THEN 150:REM TEST FOR END OF DIRECTORY
36 GRAPHICS 2:POKE 710,0:POSITION 1,1: ? #6;"file";NAME+1;"disk #6;"file ";
NAME+1;" disk ";NAME$;
37 POSITION 1,6: ? #6;A$;
38 ? "ENTER COMMENTS or 'NO' to skip"
39 ? " -----"
40 INPUT DE$:LD=LEN(DE$)
44 IF DE$="NO" THEN 34
  
```



```
46 IF LD>20 THEN 36
50 FOR B=LD TO 20:DES$(LEN(DES$)+1)=" ":NEXT B
60 FILE$(1+PT)=NAME$
75 FILE$(4+PT)=A$(3,13)
80 FILE$(17+PT)=DES$
100 PT=PT+36
120 NAME=NAME+1
140 GOTO 34
150 GRAPHICS 0:POKE 710,50
200 FOR Z=1 TO NAME*36 STEP 36
220 ? FILE$(Z,Z+35)
230 NEXT Z
240 ? :? :? "INSERT LIBRARY FILE DISK"
242 ?
245 ? :? "      HIT RETURN "
250 INPUT I$:IF I$<>" " THEN 250
260 OPEN #2,9,0,"D:PROGRAMS":REM APPEND FILE OPEN
270 FOR Z=1 TO NAME*36 STEP 36
280 ? #2;FILE$(Z,Z+36)
290 NEXT Z
300 CLOSE #2
380 ? CHR$(CLS)
390 POKE 710,180
395 ? :? "1-CREATE LIBRARY FILE"
400 ? :? "2-CATALOGUE A DISK"
410 ? :? "3-READ LIBRARY FILE INTO MEMORY"
415 ? :? "4-VIEW AND PRINT LIBRARY"
416 ? :? "5-LOAD DOS UTILITIES"
417 ? :? "6-END":? :?
418 ? :? :ER=PEEK(195):IF ER<>136 AND ER<>0 THEN POSITION 2,20:?"ERROR";ER
419 POSITION 2,14:?"SELECTION?":POKE 195,0
420 CLOSE #5:OPEN #5,4,0,"K:":GET #5,GC:NUM=GC-48:REM GET KEY VALUE
440 IF NUM<1 OR NUM>6 THEN 380
450 ON NUM GOTO 900,14,500,600,960,700
500 TRAP 300:REM READ DATA FILE ROUTINE
550 CLOSE #2:OPEN #2,4,0,"D:PROGRAMS":REM READ FILE OPEN
560 NAME=0
570 INPUT #2;C$
580 RECORD$(NAME*36+1)=C$:NAME=NAME+1
585 GOTO 570
600 POKE 710,240:REM PRINT LIBRARY ROUTINE
610 TRAP 380: ? CHR$(CLS):FOR Z=1 TO NAME*36 STEP 36
620 ? RECORD$(Z,Z+35)
630 NEXT Z
640 ? "      HARD COPY ? "
650 INPUT I$:IF I$="Y" THEN GOTO 800
670 GOTO 380
700 POKE 710,0:END
800 TRAP 380: ? CHR$(125):FOR Z=1 TO NAME*36 STEP 36
810 LPRINT RECORD$(Z,Z+35)
820 NEXT Z
830 GOTO 380
900 ? CHR$(CLS):? "THIS OPTION DELETES ANY EXISTING FILE"
910 ? :? "ARE YOU SURE Y/N"
915 ? :INPUT A$:IF A$<>"Y" THEN 380
920 IF A$="Y" THEN OPEN #2,8,0,"D:PROGRAMS"
930 GOTO 300
960 DOS
```




MOGUL

THE HOTWARE PEOPLE

METAMORPHOSIS

VIC 20 • COMMODORE 64

You have stumbled into the nest of the Cyglorx and find yourself fighting off the Robot Tanks!

£7.95

KONGO KONG

VIC 20 • COMMODORE 64

Climb ladders, avoid the barrels thrown by the Crazy Ape—rescue the Damsel.

£6.95

ZEUS

COMMODORE 64

Your Cone of Cold protects you as you become the Wizard fighting off the Thunderbolts of the angry god—Zeus.

£6.95

EARTHQUAKE

VIC 20 • COMMODORE 64

A great adventure, you are in a shopping centre during an earthquake. To save yourself you must first help the others!

£6.95

CREATORS REVENGE

COMMODORE 64

Penetrate the depths of Robot City and kill the Creator. Destroy the robots—but watch out for new robots as they hatch!

£7.95

SUPER TREK

VIC 20 • COMMODORE 64 • ORIC

Commanding the bridge of your Starship, you explore the Galaxy. Fend off the Klingon attacks with your Phasers.

£6.95

ANNIHILATOR

VIC 20 • COMMODORE 64

Defend your Planet against Invading Aliens. All machine code makes for fast and furious arcade action!

£5.99

PYRAMID

VIC 20 • COMMODORE 64

TI 99/4A

A really tough adventure game as you try to unlock the Pyramid. However the Builders have left clues everywhere.

£6.95

POLLYWOG

VIC 20

Follow the wog across danger to save his home.

£6.95

ANNIHILATOR 2

COMMODORE 64

Another Game from the author of Annihilator and Metamorphosis—Mike Wacker.

£7.95

GREAT ADVENTURE PACK

VIC 20 • COMMODORE 64

Three Great Adventures in One Package. African Escape, Hospital Adventure, Bomb Threat. Great Action, Great Value, Great Fun.

£6.95

PLUS

Four Great Games for the Spectrum 48K

POTTY PLANTER • ADDER ATTACK • LAS VEGAS LADY • CRASH

All at **£5.50**

**AVAILABLE FROM ALL GOOD DEALERS
TRADE ENQUIRIES WELCOME**

MOGUL COMMUNICATIONS LIMITED • 90 REGENT STREET • LONDON W1R 5PT

Telephone 01-437 3156/7

ADVENTURE COMPETITION

Last month we ran a competition in which we asked you to write an Adventure. This month we want you to take part in an Adventure — one in which you work your way through a series of puzzles and riddles to get to one of the golden artifacts, the key to an amazing prize. The winner of this competition gets something that is definitely rather special — computer hardware to the value of £1000. Not hardware that we've chosen, mind: the type of computer and peripherals you want depend very much on personal tastes as well as intended applications, so we're letting the winner decide for his or her self what to spend that £1000 on. If you're not too sure of your choice, we'll be happy to discuss your interests with you and recommend a system — and buy it for you.

To enter, you simply have to work your way through the questions below. Each question has a set of possible answers, only one of which is right,

and each answer also has a number indicating which is the next question you should attempt. Thus you'll be jumping back and forth through the questions, not necessarily answering them in numerical order and not even answering every one of them.

Eventually you should arrive at one of the golden artifacts strewn throughout the questions. Once you have done so, write on the form below the letters corresponding to the answers you've chosen (for example, you might have CAFBBADCE), add your name and address and post the coupon to Adventure Competition Number 2, Computing Today, 1 Golden Square, London W1 to arrive no later than January 31st. Please write the number of sides on the artifact you found on the back of the envelope to help us do a preliminary sort for the winner.

A helpful hint to those who lose their way — it isn't necessary to visit any question more than once,

one on each of the six doors. Your map says "DUP 5 ROLL PICK + . " Which door do you unlock and go through?

- A) 7 (11)
- B) 11 (6)
- C) 2 (12)
- D) 4 (13)
- E) 5 (10)
- F) 9 (7)

5. The room you are in has a central column with the number 7248551 carved into it. The base of the column is decorated with the figure 9, while the map merely says "Change to 10 to get the key". What is the key?

- A) 3870712 (3)
- B) 8144326 (7)
- C) 7860158 (14)
- D) 2764125 (10)

6. In this room a strange voice says: "In Greece I've not been heard of late, But now I've been brought up to date".

- A) Prestel (2)
- B) Ceefax (5)
- C) Oracle (14)
- D) Micronet 800 (11)

7. Three doors, each with a picture on it. The map says to follow the 16-bit fruit.

RULES OF ENTRY

This competition is open to all UK and Northern Ireland readers of Computing Today except for employees of Argus Specialist Publications Ltd, their printers, distributors or anyone associated with the competition.

All entries must be postmarked before the closing date of January 31st 1984.

No correspondence will be entered into regarding the result of this competition and it is a condition of entry that the judges decision is final.

The winner will be notified by post and the result of the competition will be published in a future issue of Computing Today.

Entries should be clearly marked on the outside of the envelope 'ADVENTURE COMPETITION NO. 2' and be addressed to our new address of 1 Golden Square, London W1.

- A) Tangerine (14)
- B) Apricot (3)
- C) Apple (5)

8. This chamber contains a golden hexagon!

9. An octagonal room with a door in each wall and a small elf. On asking directions, he replies "The exit? Try 3 and 5 or 6. It's really quite logical!"

- A) Door 1 (11)
- B) Door 2 (6)
- C) Door 3 (3)
- D) Door 4 (7)
- E) Door 5 (12)
- F) Door 6 (2)
- G) Door 7 (5)
- H) Door 8 (10)

10. This chamber contains a golden triangle!

11. You enter a room through a trapdoor and find doors in front of you, behind and to the left and right. A message scrawled in the dusty floor reads "Make a copy on disc".

- A) Go forward (8)
- B) Go back (12)
- C) Go left (2)
- D) Go right (13)

12. The walls of this room are decorated with strange symbols:

```
0000 0010 0110 0111
0101 0111 0010 0101
0101 1001 1000 1100
```

Which reptile do you use as a direction indicator?

- A) Asp (7)
- B) Mamba (6)
- C) Adder (4)
- D) Cobra (2)

13. This chamber contains a golden square!

14. She was Charles Babbage's assistant, and the US Department of Defence has immortalised her. Who is she?

- A) Ada (9)
- B) Agatha (2)
- C) Agnes (11)
- D) Alice (3)

Start here.

1. You are in a chamber with exits whose doors are marked with the names of beasts with software connections. Your map tells you that the correct door is depicted by a creature that's at home in the very warmest of climates!

- A) Elephant (7)
- B) Salamander (12)
- C) Rabbit (6)
- D) Llama (14)
- E) Phoenix (9)

2. This chamber contains five exits with strange runes (!) carved into the doors. The map says that the correct door is indicated by the answer to a riddle. "I have 40 pins, eight bits and six registers. What am I?"

- A) 6809 (8)
- B) 1802 (7)
- C) 68000 (12)
- D) 6502 (13)
- E) Z80 (5)

3. This chamber contains a golden pentangle!

4. You find a room with a stack of numbered tablets, each with a key attached. From top to bottom the tablets are numbered thus: 7 11 2 5 4 9. These numbers are repeated,

COMPUTING TODAY ADVENTURE COMPETITION NO. 2

Return to Computing Today, 1 Golden Square, London W1 before Jan 31, 1984

NAME

ADDRESS

.....

.....

.....

My answers are

Orchard COMPUTING

Britain's best buy for Apple users

Do you have access to an Apple Computer?

Would you like to have programs tailor-made to suit your business?

Do you enjoy playing challenging games?

Do you need some help writing your own programs?

If your answer is 'Yes' to any of the above questions, then you can't afford to go any longer without your copy of **Orchard Computing**.

Orchard Computing is a brand new magazine from Argus Specialist Publications. The first issue, on sale on October 28, is packed with programs for the Apple II and Apple IIe: develop your own data base, create an intelligent mailing system or learn more code; go adventuring with a massive adventure game, clear the Andromeda Nebula of galactic debris, or beat your friends at Pillar Munch; create fascinating 'pictures' with graphics programs; and find all sorts of useful utilities to help you write and modify your own programs.

Orchard Computing is a quarterly magazine and costs £2.95 for each issue. So if you use an Apple Computer, you simply can't afford to miss this exciting new magazine — why not fill out the coupon now?

SUBSCRIPTION ORDER FORM

Cut out and send to:
Orchard Computing Subscriptions,
513 London Road,
Thornton Heath,
Surrey CR4 6AR.

Please commence my subscription to
Orchard Computing with the issue

SUBSCRIPTION RATES

(tick ☐ as appropriate)

- ☐ £11.00 for 4 issues UK
☐ £12.50 for 4 issues Overseas Surface
☐ £15.00 for 4 issues Overseas Airmail

I am enclosing my cheque/ Postal Order/
International Money Order (delete as
necessary) for £..... (made
payable to ASP Ltd) or Debit my
Access/ Barclaycard (delete as necessary).

☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐

Please use **BLOCK CAPITALS** and
include post codes.

NAME (Mr/ Mrs/ Miss)

ADDRESS

..... POSTCODE

Signature

Date

University Software

LIBRARY OF ADVANCED MATH/STAT/ECON

TAPE 1: MATRIX OPERATIONS

SPECTRUM £6.95 ZX81 £5.95

Side A: Inversion, multiplication, addition, subtraction and scalar multiplication of matrices and vectors within one single program. Any output can in turn be used as the input of the next operation without re-typing. Capacity (no of rows x no of columns): 16K ZX81: 25x25, 16K Spectrum: 17x17, 48K Spectrum: 48x48.

Side B: Determinants of square matrices

TAPE 2: POLYNOMIALS

SPECTRUM £6.95 ZX81 £5.95

Side A: Includes quadratic equations (as degree 2 polynomials) and Newton-Raphson and half-interval search methods for higher degree polynomials. Computes the roots with 8 digits of precision

Side B: You can plot polynomials in any interval and examine their roots, extremum, points

TAPE 3: INTEGRATION

SPECTRUM £6.95 ZX81 £5.95

Side A: Integration of functions by Simpson's and trapezoidal rules. Also computes the area enclosed by two functions

Side B: Plot of integrals. Integration can be visualised on the screen

TAPE 4: REGRESSION

SPECTRUM £7.95 ZX81 £6.95

Side A: A highly developed multivariate regression program featuring Log/Ln option on each variable (thus allowing exponential and geometric regressions), R^2 , corrected R^2 , standard errors, t-statistics, F-statistic, degrees of freedom, Durbin-Watson statistic, interpolation. Capacity (no of variables x no of observations): 16K ZX81: 2x500, 5x250, 10x140, 16K Spectrum: 2x200, 5x100, 10x50, 48K Spectrum: 2x1800, 5x900, 10x500.

Side B: Plot of bivariate regressions. You can see how your computer draws a best-fitting line on a set of numbered data points

TAPE 5(a): LINEAR PROGRAMMING

SPECTRUM £7.95 ZX81 £6.95

Side A: A user friendly optimisation program capable of handling all sorts of linear programming problems (any combination of $\leq, =, >$, constraints and $x_i \geq 0, -a < x_i < a$ sign constraints). Features the canonical equivalent of the primal, values of slack variables and the dual. Capacity (no of variables x no of constraints): 16K ZX81: 10x23, 15x20, 20x15, 16K Spectrum: 10x10, 48K Spectrum: 10x50, 25x40, 50x30.

Side B: Solutions of simultaneous equations

TAPE 5(b): PROFESSIONAL LINEAR PROGRAMMING

£14.95

Available for 16K ZX81 and 48K Spectrum with above features plus 'save-data' and 'change-data' facilities. Any single data entry can be changed in order to observe its effect on the solution.

- All inclusive prices for the UK •
 - Tapes 1-5(a) Spectrum £35 ZX81 £30
- Cheques payable to:

UNIVERSITY SOFTWARE

29 St. Peter's Street, London N1 8JP.

Guaranteed-quality Software for TRS80/VIDEO GENIE (not colour)

PROGRAMMERS! Detailed Moving Graphics • Exciting Arcade-Style Sound • Dazzling Speed!!

Put them into YOUR programs with our trio of top-quality tools

AUTO-GRAPHICS '82 "Immediately you can create excellent and powerful graphics. Tremendous potential for special effects. Well worth buying." (Ed. Computing). Produce any possible design directly onto the screen and at a keystroke lock it permanently into YOUR program. Instantly reproduced on command. 22 functions make all graphics (especially ANIMATION) simple and FUN. Cassette/booklet only **£6.95**

AUTO SONICS "Amazing ease of use. Excellent program tool." (Ed. Computing). "A really excellent utility — 9 out of 10 for everything." (Home Comp. Wkly.)

- 26 built-in sound effects ... animals ... engines ... space sounds, etc.
- Use them just as they come or use the SYNTHESIZER CONTROL PANEL to bend and twist and shape them into thousands of new effects.
- Every sound you hear can be instantly inserted as a PERMANENT part of YOUR program. (Int. or ext. sound on Video Genie.) Cassette/Instructions only **£4.99** (Also for Spectrum — state machine).

ACCEL "How else can you describe a program that takes your brilliant but s-l-o-w Basic program and magically changes it into dazzling-fast machine code running up to 50 times faster? New improved compiler now faster than ever, with built-in System-Save facility, and new low price, only **£14.95**

THE BROOD "9 out of 10 for value and playability." (Home Comp. Wkly.) Fast intelligent ghosts, s-m-o-o-t-h action, animated gobbler, fast all M/C. EIGHT way-out sound effects. We will stand this program against any in the world, only **£4.99**

FROGGER-PLUS Superb LARGE-SCALE all-action graphics. Random traffic, logs, etc. Fast all M/C. divin' turtles, snappin' crocs that can get you on the bank, dazzling sound — naturally! Same quality as our world-beating Brood, only **£4.99**

MARAUDER/BOMBER RUN Two for the price of one. Beware — these games are addictive! All M/C. full sound **£4.50**

All programs have int. and ext. sound and control keys for ANY Genie. Please deduct 50p per cassette discount for 2nd and subsequent items.

BASE AS PREVIOUS

BUTTERCRAFT SOFTWARE

14 Western Avenue, Riddlesden, Keighley, Yorks. ENGLAND

Map 80 Systems Ltd

NEW

MPI Multi Purpose Interface
Will control a mixture of 8"/5"/3" drives
On board SASI/Winchester interface
Programable RS232 interface
Programable RS422/PN1360 high speed multi drop serial interface
On board CTC and SIO

Price	Kit	B&T
Complete MPI	£150	£185
FDC & SASI only	£125	£145

VFC Video Floppy Controller
80 col by 25 line display
On board floppy disk controller
Keyboard port
Video switch

Price	Kit	B&T
VFC Complete	£175	£214
Video only	£89	£110
FDC only	£95	£115

MAP

RAM

256K RAM card
64/32K pages or full memory mapping

Price	Kit	B&T
64K version	£105	£150
256K version	£225	£285

NOW AVAILABLE — £230

CPU MAP 80 CPU card
Memory mapped
64K RAM
2 fully programable serial channels (RS232)
Keyboard port
16 parallel I/O lines
CTC & SIO. Full interrupt control

Half height TEAC disk drive systems available from £299
CP/M 2.2 operating system £110. CP/M 3 now available £257

All prices exclude P&P (£1.50) & VAT

Dealer & OEM enquiries welcome

M.A.P. 80 Systems Ltd., No. 1 Windsor St., Chertsey, Surrey
Tel: 09328 64663



OWL

DATA CASSETTE DUPLICATION IS OUR BUSINESS

ALSO AVAILABLE

Blank C15 data cassettes
with or without leaders

Custom length. data cassettes

No order too small
For fast service phone.
(01) 848 7843

OWL TECHNICAL SERVICES Ltd.

50, Carfax Road, Hayes, Middlesex UB3 4RD

SHARP

Special Offers

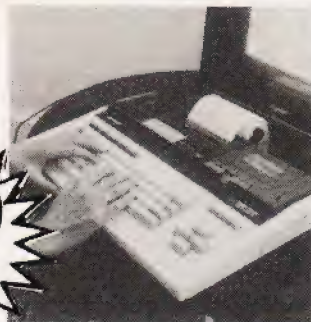
MZ-700

High quality keyboard, Z80A
3MHz 64K RAM

Full colour

Cassette Recorders
£39.95 inc VAT
4 Colour Printer
£115 inc VAT

£240
INC
VAT

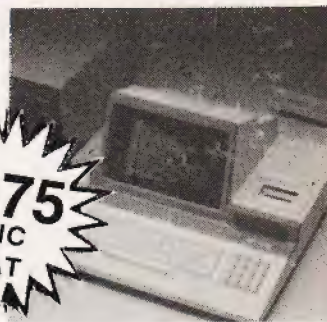


Free Carriage 'to UK Mainland

MZ-80A

The MZ-80A comes
complete with
48K RAM,
The screen and
cassette are
built in instead
of expensive extras

£375
INC
VAT



+ FREE SOFTWARE PACK

Free Carriage to UK Mainland

MZ-80B

Complete with 64K RAM
full electronic
cassette mechanism
high resolution dot
addressable graphics
40/80 col screen.

£750
INC



Free Carriage to UK Mainland

WHILE STOCKS LAST

Ex Demonstration

MZ-80P4 150 c.p.s. 132 col	640.50
MZ-80P5 80 c.p.s. 80 col	299.00

Second Hand, Part Exchanged

MZ-80K 48K RAM	288.00
MZ-80P3 80 col inc cord	375.00
MZ-80I/O Expansion unit	85.00

ALL THE ABOVE INCLUDE VAT AND CARRIAGE, 1 YRS GUARANTEE

Computer 100 Limited

181 Oxford Road
Reading
Berkshire RG1 7UZ
Tel: Reading (0734) 591616

Electronequip

Authorised BBC Dealer's Service Centre

SPECIAL OFFERS

FREE CASSETTE RECORDER

When you order a BBC Model B or Model B+ computer, a free cassette recorder will be given (while stocks last).

3" MICRO DISC DRIVE

Full capacity, very fast, 80K formatted
discs. Price 400 — 149.99
189.95 Drive cost 129.95

ATARI SPECIAL OFFER

Atari 400 computer with every com-
puter. Price 400 — 149.99
189.95 Drive cost 129.95

SPARKJET PRINTER OFFER

Sparkjet printer for BBC Model B or Model B+ computer. Price 400 — 149.99
189.95 Drive cost 129.95

TORCH Z80 DISC PACK

500K disc pack for Z80 processor with
disc controller. Price 400 — 149.99
189.95 Drive cost 129.95

Send SAE for details of all the above items.

TORCH PRICES

DDTZ80 Torch Z80 Disc pack for BBC Micro	897.00
TCPPFOR Fortran for Z80/Torch (inc special sub)	253.00
TCPPPAS Pascal for Z80/Torch (inc special sub)	253.00
TCPLANC Plannercalc Spreadsheet for Z80/Torch	97.75
TCBBCBA BBC Basic for Z80/Torch	126.50
PTTCOL Torch Colour Dot Matrix Printer	1782.50

BBC PRICES

BBC 2 BBC Model B Micro Computer	399.00
BBC 3 BBC Model A Micro with 32K	333.50
BBC 5 BBC Model B with Disc Interface	469.00
BBC 27 Disc Upgrade for BBC B (inc fitting)	92.00
BBC 30 BBC 14" Colour Monitor	287.50
BBC 44 Single Disc Drive (100K) for BBC (Teac)	211.60
BBC 45 Single Disc Drive (200K) for BBC (Teac)	269.10
BBC 46 Single Disc Drive (400K) for BBC (Teac)	349.60
BBC 47 Dual Disc Drive (200K) for BBC (Teac)	417.45
BBC 48 Dual Disc Drive (400K) for BBC (Teac)	532.45
BBC 49 Dual Disc Drive (800K) for BBC (Teac)	693.45
BBC 50 Epson FX-80 160cps Printer + Prop. spac.	449.65

ATM 2 Acorn Atom assembled 12K ram	99.95
ATM 26 Atom New Power Supply 1.8A	9.66
ATM 21 Floating Point ROM for Atom	21.85

Large stocks of software for BBC and Atom, Business, Games and Educational. Send for comprehensive lists. All printers, disc drives supplied with all cables.

All Upgrades etc. are fitted free of charge and the computer fully re-tested
Large stocks. Prices include VAT. Carriage 1.00 or 3.50.
Access and Barclaycard Welcome



14" Colour Portable TV/Monitor

This TV/Monitor is not a modified television as many TV/Monitors are, but a 14" TV/Monitor which has been designed to perform both functions. It has RGB and Composite video and sound. An RGB cable for a BBC is supplied as standard.

Cost 259.90 With remote control 279.45

TRADE ENQUIRIES WELCOME



Electronequip



36-38 West Street, Fareham, Hants TO16 0JW (0329) 230 670

TRS-80 SCREEN EDITOR

Line editing is a bit of a dinosaur in computing circles, and this program will make it extinct for owners of the TRS-80. You have the choice of using the assembly listing or a BASIC version.

I have owned a TRS-80 for some time now, and have purchased a lot of software for it including various utilities of one type or another. Probably the best utility I ever bought was a full-screen editor, but one problem with it was that you were limited to line lengths of 54 characters. I therefore decided to write my own full-screen editor and the following program is just that. It works in a similar way to the Screen Editor for the BBC computer: you move a second cursor to the characters you wish to copy and press the Copy key.

You enter edit mode by pressing Control E (E for Edit). The control key is Shift Down-arrow. Upon pressing this key a flashing cursor will appear at the position of the normal cursor which you can then pilot around the screen using the arrow keys. Note that the arrow keys and the Clear key will lose their normal functions when edit mode is entered, though all other keys still retain their normal values, and the 'missing' keyboard characters can be accessed via Control keys:

Control H = backspace
Control I = tab
Control J = line feed
Control Y = up arrow
Control X = backspace and erase whole line.

You may copy characters from anywhere on the screen to the normal cursor (just as if you'd typed them) by pressing the Clear key. Any characters can be copied, including graphics characters, and you are limited only to the length of the Level II keyboard buffer — 240 characters.

To exit from the Editor, you may use Control E, Enter or Break. Control E will switch off the editor keeping any characters that you copied intact, but restoring the function of all keys. Enter will enter the line that you copied as

though you had just typed it. Break will throw away the line that you typed, just as though you had typed a line and pressed the Break key.

To run the program you may either type in the assembler listing and assemble it, or type the BASIC program listing which will poke the program into memory (not forgetting to save the BASIC program!). The BASIC program version is written for 16K machines only, does NOT relocate, is patched into the keyboard chain by executing the USR call, and must have had MEM size set at 32352 before running. The assembler version of the program will relocate itself to high memory, set its own MEM size, and patch itself into the keyboard chain. The

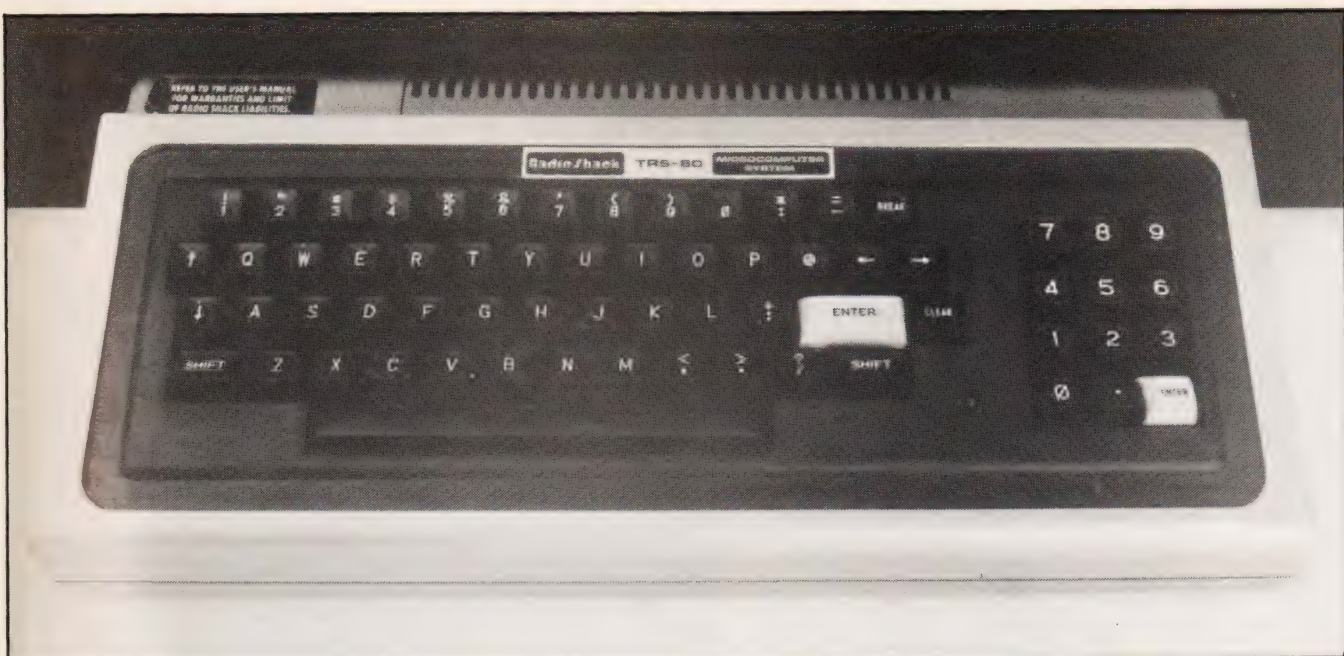
editor may be entered at any time using Control E.

A few final points:

- The arrow keys and the copy key repeat if held down in edit mode. No other key will repeat unless you have loaded a key repeat program.
- The copy cursor will wrap around the screen.
- The program will not work properly in 32-character screen mode and will reset the screen to 64-character mode.
- All keyboard characters can still be accessed when in Editor, with the exception of the Clear key and Shift-Right arrow (32 characters per line mode) — this will prevent the screen display being inadvertently messed up by the user.
- The program is compatible with Level II or DOS and does not alter the current keyboard driver, ie this program does not give you key repeat; but if you have such a program in memory this program will not remove it.

Listing 1. The corresponding BASIC listing to POKE the machine code into place.

```
20 REM Program Name :EDIT/bas
40 REM Create Date & Time :09/14/83 00:26:37
60 REM Full Screen Editor for 16K (Level II or Dos)
80 REM SET MEM SIZE TO 32352
100 CLS:PRINT"*** Full Screen Editor ***"
120 PRINT"Poking program into memory."
140 FORN=32354 TO 32767:READ D
160 CS=CS+D
180 IF N=32767 THENI=65536-N ELSE I=N
200 POKEI,D:NEXTN
220 IFCS( )44623THENPRINT"Error in Data":END
240 MS=INT(32747)/256:LS=32747-(MS*256)
260 IFPEEK(16396)=201THENPOKE16526,LS:POKE16527,MS ELSE DEFUSR0=32747
280 S=USR(0)
300 END
320 DATA0,60,0,0,0,0,0,42,32,64,34,98,126,126,50,100,126,175,50,61,64,211,255,
58,127,56,183,32,250
340 DATA175,201,205,0,0,50,102,126,254,26,40,244,254,5,32,11,205,199,127,183,32,
212,205,221,127,24,229,87,58,101,126
360 DATA183,32,4,58,102,126,201,126,254,13,40,4,254,1,32,10,205,221,127,205,199,
127,58,102,126,201,42,98,126,58,104
380 DATA126,183,32,5,205,208,127,24,15,58,103,126,60,254,100,40,5,50,103,126,24,
22,175,50,103,126,42,98,126,62,127
400 DATA190,32,3,58,100,126,119,1,184,11,205,96,0,58,60,64,42,98,126,71,230,32,4
0,6,205,221,127,43,24,80,120
420 DATA230,64,40,5,205,221,127,35,24,69,120,17,64,0,230,8,40,8,205,221,127,183,
237,82,24,53,120,200,16,40,12
440 DATA58,126,56,183,32,51,205,221,127,25,24,36,120,230,2,40,40,205,221,127,126
,71,254,32,243,57,127,203,247,71,230
460 DATA192,238,192,120,32,2,203,183,35,205,169,127,34,98,126,24,21,205,169,127,
34,98,126,195,128,126,175,50,105,126,58
480 DATA102,126,183,200,205,221,127,245,42,32,64,17,64,0,25,124,254,64,32,11,125
,254,63,40,14,241,245,254,10,40,8
500 DATA241,254,25,32,2,62,91,201,42,98,126,175,237,82,205,142,127,34,98,126,24,
234,245,213,124,17,0,4,254,60,250
520 DATA160,127,254,64,243,163,127,24,6,25,24,3,183,237,82,209,241,201,205,142,1
27,245,197,58,105,126,183,32,5,1,32
540 DATA78,24,3,1,172,13,205,96,0,62,1,50,105,126,193,241,201,58,101,126,238,1,5
0,101,126,201,126,50,100,126,62
560 DATA1,50,104,126,34,98,126,201,245,58,100,126,42,98,126,119,175,50,104,126,2
41,201,42,22,64,34,131,126,33,130,126
580 DATA34,22,64,201,151,87,35,52,195,120,127,229
```

Listing 2. The assembler listing for the full screen editor.

```

00100 ;the following line is only legal if you are using
00110 ;the Misosys Edas assembler and should not be entered
00120 ;if you are using any other assembler.
00130 TITLE '(Full-Screen Editor 1.4)'
00140 ;EDITOR - version for Dos or Level II
00150 ORG 00002H ;for now
00160 START DEFW 7070H ;flas!
00170 CURSOR EDU 4020H ;twish a bit of luck
00180 PAUSE EDU 0060H ;from delay routine
00190 ARROWS EDU 403CH ;arrow key row store
00200 KEYON EDU 307FH ;iscans all keys at once!
00210 DELAY1 EDU 2000H ;initial delay for repeat keys
00220 DELAY2 EDU 3500 ;debounce delay
00230 DELAY3 EDU 100 ;flash speed
00240 SHIFT EDU 3080H ;tshift key row address
00250 DSP EDU 0033H ;from video display routine
00260 MEMSIZ EDU 4049H ;mem size in Doss
00270 MEHL1 EDU 40B1H ;mem size in Level II
00280 SYSTAT EDU 16396 ;in Level II this location
00290 ;contains a RET. In Dos it
00300 ;does not - hence we can tell
00310 ;by looking at this location
00320 ;whether we are in L II or Dos.
00330 CURS2 DEFW 3000H ;second (copy) cursor
00340 CHAR DEFB 0 ;tchar 8 second cursor
00350 EDITON DEFB 0 ;editor switch
00360 STROKE DEFB 0 ;keystroke store
00370 CURS2F DEFB 0 ;timer for flash
00380 SAVED DEFB 0 ;icurrent-char-saved flas
00390 RFLAG DEFB 0 ;key repeat flas
00400 ENTER1 LD HL,(CURSOR) ;icold start
00410 RLD1 LD A,(HL) ;tset char
00420 RLD2 LD A,(CHAR) ;tstore it
00430 ;the next 3 instructions stop the program from running
00440 ;in 32 chars per line mode.
00450 XOR A ;tld a with 0
00460 LD A,(16445) ;tput us in 64 col mode
00470 OUT A,($FF) ;treset port
00480 WASTE LD A,(KEYON) ;ttest all keys in one
00490 OR A ;tany keys pressed?
00500 JR NZ,WASTE ;twait 'til they let go!
00510 ;this means that the cursor doesn't move until our user
00520 ;has let go of the shift down-arrow and E keys!
00530 THROW XOR A ;tld A,0
00540 RET ;treturn with 0 in A
00550 ;EYRTN CALL ;tthe address of the current
00560 ;keyscan routine will be put here when the program
00570 ;is initialised.
00580 RLD1 LD A,(STROKE) ;tstore it for now
00590 CP 26 ;tshift d-arrow (old-trm TRS-80's)?
00600 JR Z,THROW ;tshift d-arrow with no key press
00610 CP 5 ;tcontrol E?
00620 JR NZ,TRYEDT
00630 RLD4 CALL TOGGLE ;ttoggle value in (editon)
00640 OR A ;teditor off? - z if zero
00650 JR NZ,ENTER1 ;tentent editor
00660 EXIT1 CALL RESTOR ;tturn off curs2 & restore char
00670 ;tturn with a 0 in A reg
00680 THROW ;tstore A val
00690 LD A,(EDITON)
00700 OR A ;tis it edit on?
00710 JR NZ,TRYSK3 ;tyes
00720 ;tnow process for (enter) and (break)
00730 LD A,(STROKE) ;tno - restore keystroke
00740 RET ;ttoo back with key
00750 LD A,0 ;tcheck for Enter or Break
00760 CP 15 ;tis it (Enter)?
00770 JR Z,EXIT2 ;tyes - (Enter) exit
00780 CP 1 ;tis it (Break)?
00790 JR NZ,EDIT1 ;tno - a normal key
00800 ;ttoo core through here if (enter) or (break) pressed
00810 ;tand edit is turned on
00820 EXIT0 CALL RESTOR ;tturn it off!
00830 TOGGLE ;ttoggle
00840 RLD6 LD A,(STROKE) ;trestore the char
00850 RET ;ttoo back with it
00860 EDIT1 LD HL,(CURS2)
00870 LD A,(SAVED) ;tis this char stored?
00880 OR A ;tzero if not
00890 JR NZ,EDIT2 ;tyes it is
00900 STOR ;tno - so and do it
00910 LD A,FLASH ;tdisplay the flashing cursor
00920 LD A,(CURS2F)
00930 INC A
00940 DELAY3 ;thave we waited long enough?
00950
00960
00970
00980
00990
01000
01010
01020
01030
01040
01050
01060
01070
01080
01090
01100
01110
01120
01130
01140
01150
01160
01170
01180
01190
01200
01210
01220
01230
01240
01250
01260
01270
01280
01290
01300
01310
01320
01330
01340
01350
01360
01370
01380
01390
01400
01410
01420
01430
01440
01450
01460
01470
01480
01490
01500
01510
01520
01530
01540
01550
01560
01570
01580
01590
01600
01610
01620
01630
01640
01650
01660
01670
01680
01690
01700
01710
01720
01730
01740
01750
01760
01770
01780
01790
01800
01810
01820
01830
01840
01850
01860
01870
01880
01890
01900
01910
01920
01930
01940
01950
01960
01970
01980
01990
02000
02010
02020
02030
02040
02050
02060
02070
02080
02090
02100
02110
02120
02130
02140
02150
02160
02170
02180
02190
02200
02210
02220
02230
02240
02250
02260
02270
02280
02290
02300
02310
02320
02330
02340
02350
02360
02370
02380
02390
02400
02410
02420
02430
02440
02450
02460
02470
02480
02490
02500
02510
02520
02530
02540
02550
02560
02570
02580
02590
02600
02610
02620
02630
02640
02650
02660
02670
02680
02690
02700
02710
02720
02730
02740
02750
02760
02770
02780
02790
02800
02810
02820
02830
02840
02850
02860
02870
02880
02890
02900
02910
02920
02930
02940
02950
02960
02970
02980
02990
03000
03010
03020
03030
03040
03050
03060
03070
03080
03090
03100
03110
03120
03130
03140
03150
03160
03170
03180
03190
03200
03210
03220
03230
03240
03250
03260
03270
03280
03290
03300
03310
03320
03330
03340
03350
03360
03370
03380
03390
03400
03410
03420
03430
03440
03450
03460
03470
03480
03490
03500
03510
03520
03530
03540
03550
03560
03570
03580
03590
03600
03610
03620
03630
03640
03650
03660
03670
03680
03690
03700
03710
03720
03730
03740
03750
03760
03770
03780
03790
03800
03810
03820
03830
03840
03850
03860
03870
03880
03890
03900
03910
03920
03930
03940
03950
03960
03970
03980
03990
04000
04010
04020
04030
04040
04050
04060
04070
04080
04090
04100
04110
04120
04130
04140
04150
04160
04170
04180
04190
04200
04210
04220
04230
04240
04250
04260
04270
04280
04290
04300
04310
04320
04330
04340
04350
04360
04370
04380
04390
04400
04410
04420
04430
04440
04450
04460
04470
04480
04490
04500
04510
04520
04530
04540
04550
04560
04570
04580
04590
04600
04610
04620
04630
04640
04650
04660
04670
04680
04690
04700
04710
04720
04730
04740
04750
04760
04770
04780
04790
04800
04810
04820
04830
04840
04850
04860
04870
04880
04890
04900
04910
04920
04930
04940
04950
04960
04970
04980
04990
05000
05010
05020
05030
05040
05050
05060
05070
05080
05090
05100
05110
05120
05130
05140
05150
05160
05170
05180
05190
05200
05210
05220
05230
05240
05250
05260
05270
05280
05290
05300
05310
05320
05330
05340
05350
05360
05370
05380
05390
05400
05410
05420
05430
05440
05450
05460
05470
05480
05490
05500
05510
05520
05530
05540
05550
05560
05570
05580
05590
05600
05610
05620
05630
05640
05650
05660
05670
05680
05690
05700
05710
05720
05730
05740
05750
05760
05770
05780
05790
05800
05810
05820
05830
05840
05850
05860
05870
05880
05890
05900
05910
05920
05930
05940
05950
05960
05970
05980
05990
06000
06010
06020
06030
06040
06050
06060
06070
06080
06090
06100
06110
06120
06130
06140
06150
06160
06170
06180
06190
06200
06210
06220
06230
06240
06250
06260
06270
06280
06290
06300
06310
06320
06330
06340
06350
06360
06370
06380
06390
06400
06410
06420
06430
06440
06450
06460
06470
06480
06490
06500
06510
06520
06530
06540
06550
06560
06570
06580
06590
06600
06610
06620
06630
06640
06650
06660
06670
06680
06690
06700
06710
06720
06730
06740
06750
06760
06770
06780
06790
06800
06810
06820
06830
06840
06850
06860
06870
06880
06890
06900
06910
06920
06930
06940
06950
06960
06970
06980
06990
07000
07010
07020
07030
07040
07050
07060
07070
07080
07090
07100
07110
07120
07130
07140
07150
07160
07170
07180
07190
07200
07210
07220
07230
07240
07250
07260
07270
07280
07290
07300
07310
07320
07330
07340
07350
07360
07370
07380
07390
07400
07410
07420
07430
07440
07450
07460
07470
07480
07490
07500
07510
07520
07530
07540
07550
07560
07570
07580
07590
07600
07610
07620
07630
07640
07650
07660
07670
07680
07690
07700
07710
07720
07730
07740
07750
07760
07770
07780
07790
07800
07810
07820
07830
07840
07850
07860
07870
07880
07890
07900
07910
07920
07930
07940
07950
07960
07970
07980
07990
08000
08010
08020
08030
08040
08050
08060
08070
08080
08090
08100
08110
08120
08130
08140
08150
08160
08170
08180
08190
08200
08210
08220
08230
08240
08250
08260
08270
08280
08290
08300
08310
08320
08330
08340
08350
08360
08370
08380
08390
08400
08410
08420
08430
08440
08450
08460
08470
08480
08490
08500
08510
08520
08530
08540
08550
08560
08570
08580
08590
08600
08610
08620
08630
08640
08650
08660
08670
08680
08690
08700
08710
08720
08730
08740
08750
08760
08770
08780
08790
08800
08810
08820
08830
08840
08850
08860
08870
08880
08890
08900
08910
08920
08930
08940
08950
08960
08970
08980
08990
09000
09010
09020
09030
09040
09050
09060
09070
09080
09090
09100
09110
09120
09130
09140
09150
09160
09170
09180
09190
09200
09210
09220
09230
09240
09250
09260
09270
09280
09290
09300
09310
09320
09330
09340
09350
09360
09370
09380
09390
09400
09410
09420
09430
09440
09450
09460
09470
09480
09490
09500
09510
09520
09530
09540
09550
09560
09570
09580
09590
09600
09610
09620
09630
09640
09650
09660
09670
09680
09690
09700
09710
09720
09730
09740
09750
09760
09770
09780
09790
09800
09810
09820
09830
09840
09850
09860
09870
09880
09890
09900
09910
09920
09930
09940
09950
09960
09970
09980
09990

```



```

0100 FE40 01830 CP 40H 11ast line?
010D 2000 01840 JR N2,DKRTN 11no - don't worry
01850 11to get here we're on the last screen line, and so we
01860 11have to check our character
01870 LD A,L
01880 CP 63 11ast screen location?
01890 JR Z,ALTER2 11char will cause a scroll
018A0 POP AF
018B0 PUSH AF 11store value in A res
018C0 CP 10 11line feed?
018D0 JR Z,ALTER2 11yes so we'll scroll
018E0 POP AF
018F0 CP 25 11control Y ? (up arrow in edit)
01900 JR NZ,DK2 11no
01910 LD A,91 11id a with up arrow char
01920 RET 11no back with key
01930 ALTER2 LD HL,(CURS2)
01940 XOR A
01950 SBC HL,DE 11de was 64 already
01960 CALL CHEKHL 11keep HL on screen
01970 LD (CURS2),HL 11store it
01980 JR DKRTN
01990 02050 11chehki only alters hl if it lies outside of the range
02060 11of the video display 3000H to 3FFFH
02070 CHEKHL PUSH AF 11save the res
02080 PUSH DE
02090 LD A,H 11test hbi!
02100 LD DE,1024 11video size
02110 CP 3CH 11underflow?
02120 RLD27 JP M,TOLOW 11yes!
02130 CP 40H 11overflow?
02140 RLD28 JP P,TOOHI 11yes!
02150 JR OK 11no problem
02160 ADD HL,DE 11make it the right size
02170 JR OK
02180 TOOHI OR A 11clear carry
02190 SBC HL,DE 11make it the right size
02200 POP DE
02210 POP AF
02220 RET
02230 11check hl value and delay
02240 CHEKHL CALL CHEKHL
02250 PUSH AF
02260 PUSH BC
02270 RLD40 LD A,(RFLAG) 11test repeat-status
02280 OR A 11is the flag set?
02290 JR NZ,DK200 11yes - do a short delay
02300 LD BC,DELAY1 11no - do a long delay
02310 JR DK200
02320 DK200 LD BC,DELAY2 11debounce delay
02330 PAUSE
02340 LD A,1 11set auto-repeat flag
02350 LD (RFLAG),A 11store it
02360 POP BC
02370 POP AF
02380 RET
02390 TOGGLE LD A,(EDITON) 11toggle value in (editon)
02400 XOR A 11toggle it
02410 RLD29 LD (EDITON),A 11put it back
02420 RET 11go back to caller
02430 LD A,(HL) 11save char @ hl
02440 RLD30 LD (CHAR),A
02450 LD A,1
02460 RLD31 LD (SAVED),A 11current char stored flag
02470 RLD32 LD (CURS2),HL 11and store HL
02480 RET
02490 RESTOR PUSH AF
02500 RLD33 LD A,(CHAR) 11test old char
02510 RLD34 LD HL,(CURS2) 11test posn of char
02520 LD (HL),A
02530 XOR A 11id a 0
02540 RLD35 LD (SAVED),A
02550 11this routine is called prior to changing the value
02560 11in (CURS2) we will not have stored the char at this new
02570 11location - Hence we flag this fact in (saved)
02580 POP AF
02590 RET
02600 SETUP PUSH HL
02610 LD HL,WELCOM 11loading message
02620 SETUP2 CALL VWRITE 11my Video write routine!
02630 LD HL,(0015H) 11test addr of current
02640 11keyboard scan routine,
02650 RLD36 LD (KEYRTN+1),HL 11use THIS routine for
02660 11keyboard scan.
02670 RLD37 LD HL,KEYRTN 11test addr of my rtn
02680 LD (0015H),HL 11keys can will go there
02690 11we have inserted the routine into the keyboard scan
02700 11vector, and our routine is now called instead. The
02710 11current keyboard driver is preserved.
02720 POP HL
02730 LD A,(SYSTAT) 11are we in dos or L 2 ?
02740 CP 201
02750 JP NZ,402DH 11dos return
02760 CALL 1E7AH 11basic clear fixes pointers
02770 JP 1A19H 11level II return
02780 11relocating bit!
02790 NUBASE DEFW 0000H
02800 02810 RELOC LD SP,START-2 11level II or Dos will
02820 11reset their value for the SP on return from this
02830 11routine. We only move the stack pointer to prevent our
02840 11routine being overwritten by the stack during our
02850 11set-up procedure.
02860 PUSH HL 11save those registers
02870 PUSH AF
02880 PUSH BC
02890 PUSH DE
02900 11the next line restores SYSTEM command
02910 11the tape autostart places a JP instruction there
02920 11so we put back the RET that used to be there
02930 LD A,201
02940 LD A,(41E2H),A 11set up a RET at 41E2H
02950 LD A,(SYSTAT)
02960 CP 201 11test for level II
02970 JR Z,NODOS1
02980 LD HL,(MEMSIZ) 11new size in DOS
02990 CONT
03000 NODOS1 LD HL,(MEML1) 11test new size in level II
03010 CONT2 LD DE,SETUP-START* 11set program length
03020 SBC HL,DE 11set up new mem size!
03030 LD (NUBASE),HL 11new base address
03040 PUSH HL
03050 DEC HL 11value in mem size must be
03060 DEC HL 112 bytes less than required.
03070 CP 201 11test for level II
03080 JR Z,NODOS2
03090 LD (MEMSIZ),HL 11new mem size for dos
03100 LD HL,CONT3
03110 NODOS2 LD (MEML1),HL 11new mem size for level II
03120 LD DE,0FFCEH 11clear 50bytes string spc
03130 ADD HL,DE
03140 LD (40BAH),HL 11string area pointer
03150 CONT3 LD DE,START
03160 POP HL 11test program start
03170 XOR A 11clear carry
03180 SBC HL,DE 11HL sets how much each
03190 LD (DISPL),HL 11
03200 11old address has to be altered by to relocate
03210 11it to the New address.
03220 11oldsp contains HL-DE (newbase-oldbase)
03230 LD HL,TABLE 11table of addresses to

```


YOUR MICRO COULD TEACH YOU A THING OR TWO ABOUT THE FRENCH... ...OR THE GERMANS...OR THE SPANISH

A home computer is an expensive toy; and, if playing games is all you do with it, a toy is all it is.

Now, using the New Personal Computer Superlearning System (PCSS) you can have fun with your micro and learn something at the same time.

PCSS language courses comprise 12 lessons on 3 audio cassettes used in conjunction with a fourth software cassette, to add a new dimension to learning.

Initially the software package enables you to see the words you're learning; then, as your vocabulary develops, it will test your skill in your new language.

Anyone can learn this way - no previous knowledge of the language is required. The unique PCSS method develops your overall learning and memory skills in a way that's both relaxing and enjoyable.

Each PCSS language pack - French, German or Spanish - contains a comprehensive booklet detailing

the 12 audio lessons and the function of the interactive software. Additionally the booklet expands on the broader benefits of the PCSS method.

At only £29.95 per pack PCSS costs less than other home language courses yet it offers much more in terms of education and enjoyment.

Complete the coupon below and try PCSS for yourself - you'll be amazed what your micro can teach you.

MDA

COMPUTERISED EDUCATION SYSTEMS

(PCSS software is compatible with the ZX81 (16K), ZX Spectrum, BBC Micro, Acorn Electron Micros.)

Each pack comes with a full money back guarantee if not completely satisfied.

Send your cheque or Postal Order for **£29.95** made payable to:
**MDA Modon Associates Limited, 561 Upper Richmond Road West,
London SW14 7ED.** (ZX81 users **£26.95**)

or, alternatively phone **Teledata 01 200 0200** now, lines open 24 hours and quote your Visa, Diners Club, Access or American Express number.

Tick which Audio/software package you require. (Prices include VAT. Add £1.45 for postage and packing on each order.)

Please supply the following Audio/software Packages

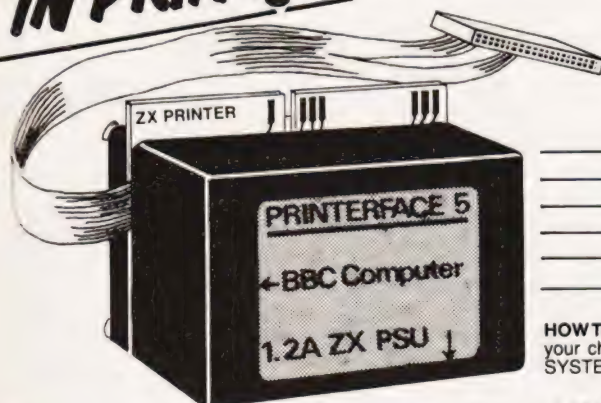
FRENCH ☐ GERMAN ☐ SPANISH ☐

Name:

Address:

Machine Type: Memory Size:

**FOR JUST
£29.95+p&p
YOU CAN PUT
IT IN PRINT!**



You can connect a Sinclair ZX Printer to your 6502 Computer by simply plugging the right PRINTFACE unit to your system giving you up to 43 characters line or 256 Dixel graphics.

For MICROTAN
(ask for Printface 1)

For DRAGON 32
(ask for Printface 2)

For ATOM/ACORN
(ask for Printface 3)

For ORIC
(ask for Printface 4)

For BBC COMPUTER
(ask for Printface 5)

For VIC 20
(ask for Printface 6)

HOW TO ORDER Please enter your requirements in the coupon below, enclosing your cheque or postal order, made payable to: MICROTANIC COMPUTER SYSTEMS LTD. Please allow 14 days for delivery.

MICROTANIC COMPUTER SYSTEMS LTD.
16 UPLAND RD DULWICH
LONDON SE22
TEL: (01) 693 1137

Post to: MICRO COMPUTER SYSTEMS LTD
16 UPLAND ROAD DULWICH LONDON SE22

Please send me the following items;

I need "INTERFACE" UNIT for (state your computer system)

I enclose my cheque/P.O. for £

Name

COMPANY

ADDRESS

TEL (DAY)

TEL (EVE)

Paul Gardner

LEARNING FORTH PART 3

Now you're getting more familiar with the FORTH dictionary, you may find you need more types of control structure and extra words. Here's how to branch and loop, and 'roll your own'.

No serious programming language would be complete without the necessary structures which allow you to repeat sections of a program or make decisions within a program. This month we will see what FORTH has to offer the 'structured programmer'. Also, by explaining the way definitions are stored in the dictionary we shall see how it is possible to create your own data types.

LOOPS AND BRANCHES

Several structures are available in FORTH for decision making or repeating, but the format of these is a little unusual when compared with languages such as BASIC. The first of these is the IF-ELSE-THEN structure. The way it works is best shown by an example. Assume there is a number on the top of the stack which represents the temperature in centigrade of a cooling unit.

```
: HEATINGMONITOR ( temperature -- )
  DUP ABS .
  0 <
  IF ( if temperature below zero )
    ." degrees below freezing "
  ELSE ( temperature is above zero )
    ." degrees above freezing "
  THEN
;
```

If you try the program with a few different values you see the output is of the form "10 degrees below freezing" if -10 was on the stack, or "10 degrees above freezing" if +10 was on the stack. Figure 1 is a flowchart representation of this program.

The FORTH word ABS takes a value off the stack and returns its absolute value, ie the same number but with its sign ignored, so that it is left zero or positive. This is printed out using . . DUP makes sure that we still have a copy of the temperature, either positive or negative, on the stack for the next phrase to use.

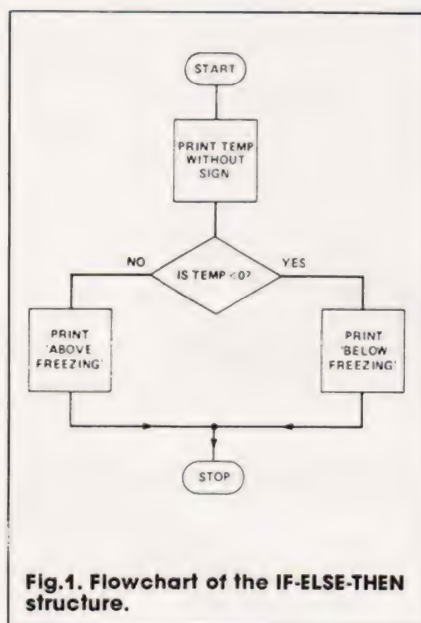


Fig.1. Flowchart of the IF-ELSE-THEN structure.

The next expression is the 'conditional phrase' 0<(less than zero). I will explain the use of conditional phrases shortly but for the moment we will assume that this phrase will leave a 'flag' meaning true or false on top of the stack for IF to use.

IF makes a decision between two paths: one from IF to ELSE, and the other from ELSE to THEN. The paths 'join up' again after THEN. IF bases its decision on the number on top of the stack (and it discards the number afterwards), so this number is the 'condition'. If the condition is 0 (false), it goes to the path between ELSE and THEN. If the condition is not 0 (true) it goes to the path between IF and ELSE. You can think of IF, ELSE and THEN as meaning:

IF the number on the stack is true follow this path

ELSE if it was false follow this one THEN afterwards in either case carry on here.

You should notice here the difference between FORTH and BASIC with regard to the order of things:

BASIC — IF condition THEN action

FORTH — condition IF action if true ELSE action if false THEN.

With FORTH the conditional expression which leaves a true or false flag on the stack comes before the IF in the same way that the numbers used by the arithmetic operators come before the operator. Also, FORTH provides you with an ELSE section to follow if the condition yielded false. This ELSE section is optional and can be left out. For example a word that would use a number on the stack and give a warning if it was negative:

```
: BANK-MONITOR ( balance -- )
  0 <
  IF
    ." Your account is overdrawn "
  THEN
;
```

Since for numbers that are positive you don't need to do anything, you don't need ELSE.

In the previous examples, IF used a flag left on top of the stack by a FORTH testing word 0<(less than zero). Several words are available which operate on the top of the stack to leave either a true, 1, or false, 0, flag, as shown in Table 1. As many comparisons are based on the value 0, two words have been defined, 0= and 0<, which work in the same way as 0 = and 0 < (ie number space operator) but rather faster.

FOR MATHS BUFFS

Numbers or flags which are on top of the stack can be combined using the Boolean operators AND, OR and XOR. Each of these words takes the top two values from the stack and leaves the result. If the numbers on the stack were technically valid as flags (ie either 0 or 1) then the words act as true Boolean operators. If the numbers, however, were greater than one then the words AND, OR, etc act

=	(n1,n2 -- flag)	takes the top two numbers off the stack and tests to see if they are equal
<	(n1,n2 -- flag)	flag true if n1<n2, otherwise false
>	(n1,n2 -- flag)	flag true if n1>n2, otherwise false

Table 1. The comparison functions that are available.

as bitwise Boolean operators. For example:

```
1 0 AND .
0 ok
```

whereas:

```
4 6 AND .
4 ok
```

as the bitwise operator gives

```
00000100 = 4
00000110 = 6
00000100 = 4
```

LOOPING THE LOOP

We've all come across expressions in Basic such as

```
FOR A=1 TO 10: PRINT A: NEXT A
```

FORTH offers a similar structure for repeating sections of a program, for example:

```
: COUNT-UP
11 1
DO
I . ( I returns the value of the
    counter for the loop)
LOOP
;
```

The DO-LOOP is a little different from the BASIC FOR-NEXT in several ways. The limit and the starting point are removed from the stack by the word DO and are kept in a 'safe place' (actually another stack called the return stack — more of that later). The test to compare the count and the limit is performed by the word LOOP so that the commands between DO and LOOP are executed at least once. Also, execution of the loop finishes when the count equals or exceeds the limit, so in my version of COUNT-UP the output would be:

```
1 2 3 4 5 6 7 8 9 10 ok
```

The word LOOP actually adds 1 to the count and then compares it to the limit. If they are not equal then the program carries on from just after DO; if they are equal then the looping stops. This is why the

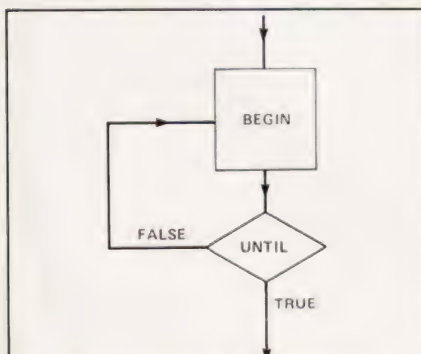


Fig.2. Flowchart for the BEGIN-UNTIL structure.

I	(-- n)	returns to the stack the value of the counter of the loop
I'	(-- n)	returns to the stack the value of the limit of the loop
J	(-- n)	will return the counter of an outer loop if one loop is nested within another

Table 2. Loop counter manipulation words.

number 11 is not printed by COUNT-UP.

You should also note that the counter (which is held in that 'safe place') does not have a name like the BASIC FOR loop which used the variable A. There are, however, three useful words which allow you to keep track of the counter, shown above. For example:

```
: TIMES-TABLES
13 0
DO
13 0 DO CR
I . " multiplied by "
J . " equals " I J * .
LOOP
LOOP
;
```

If you do not want the count to increase by one on each loop then a word +LOOP is available which is shown below:

```
: COUNT-UP-IN-TWOS
10 0 DO
I .
2 +LOOP
;
```

The word +LOOP takes a value off the stack and adds it to the loop counter before comparing the counter to the limit. In this way the loop can be made to count down, by adding a negative number to the counter:

```
-2 +LOOP
```

It is possible to leave a DO-LOOP prematurely by using the command LEAVE, which sets the counter equal to the limit so that the loop will terminate at the next test.

BEGIN-UNTIL

A useful word in Abersoft's FORTH is INKEY; this returns to the top of the stack the ASCII value of the key being pressed (if any), or 255 if no key is being pressed. This is often used to make the computer wait for a key press before continuing:

```
: WAIT-FOR-ME
1000 0 DO LOOP ( gives you
                time to let go of enter key)
BEGIN
INKEY 255 <
UNTIL
;
```

UNTIL (flag —) expects a true (non-zero) or false (zero) flag on top of the stack. If the flag is false then control jumps back to BEGIN, if the flag is true then the program carries on after UNTIL; see Fig. 2. In this way an infinite loop can be set up using 0 UNTIL. (Don't try using this unless you want to turn off your machine soon!) For example:

```
: INFINITE
." I go "
BEGIN
." on and "
0 UNTIL
;
```

In this case the loop will never be terminated.

BEGIN-WHILE-REPEAT

You should have noticed that in the BEGIN-UNTIL structure, the commands between BEGIN and UNTIL are executed at least once. The test whether to loop around again is made by UNTIL. Verbally it goes:

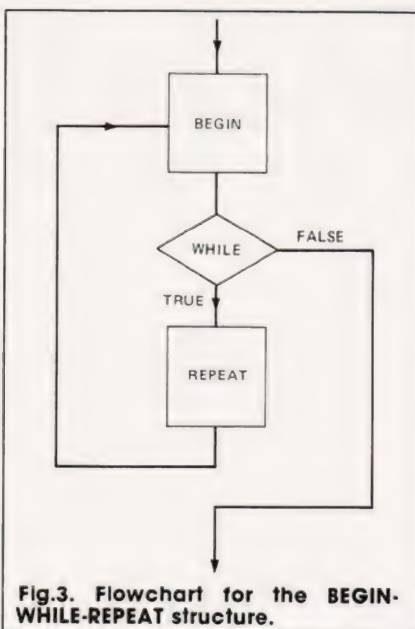
BEGIN here and go round and round until the condition used by UNTIL is true.

There is another structure in FORTH which allows you to test a condition before the contents of a loop are executed. For example, using INKEY again we could have a small loop that waits until you let go of a key before continuing.

```
: WAIT-TILL-HE-LETS-GO ( long
                        titles are sometimes
                        descriptive!)
BEGIN
INKEY 255 = NOT ( NOT changes
                  the flag around)
WHILE
." Get your fingers off me " CR
REPEAT
;
```

The WHILE word expects a flag on the stack. If the flag is true the path between WHILE and REPEAT is followed; if the flag is false control passes to the point after REPEAT.

If the condition is true, then when execution reaches REPEAT control jumps back to the word BEGIN. It is usually the commands between BEGIN and WHILE that evaluate the flag for WHILE to use; see Fig.3. An example that uses both BEGIN-UNTIL and BEGIN-WHILE-REPEAT is given below.



Imagine your micro controls the home's heating system, and that you have defined a few words already as follows:

```

TEMP? (-- n)
measures the temperature of the
room and puts the value on the
stack

THERMOSTAT? (-- n)
reads the current setting of the
thermostat and puts the value on
the stack

HEAT-ON (-- )
turns central heating on

HEAT-OFF (-- )
turns central heating off

: TILL-HOT ( waits until
temp >= thermostat)
BEGIN
TEMP? THERMOSTAT? <
WHILE ( do nothing)
REPEAT
;

: TILL-COLD ( waits until
temp <= thermostat)
BEGIN
TEMP? THERMOSTAT? >
WHILE ( do nothing)
REPEAT
;

: HEATING-CONTROL
HEAT-ON ( at start of system)
BEGIN
TILL-HOT HEAT-OFF
TILL-COLD HEAT-ON
0 UNTIL
;
  
```

JUST IN CASE

One of the most useful commands in a language such as Pascal is the CASE statement. This allows for the testing of a number for many different values and executing different procedures on each value (similar to the ON-

GOSUB structure in some BASICS). This is available in standard FORTH only by using many nested IF-IF-THEN-THENs and can be very difficult to follow. A structure provided by Abersoft's FORTH is called the CASE structure. Its use is:

```

( instructions leaving a single
value on the stack)

CASE
8 OF ." This is 8" CR ENDOF
12 OF ." This is 12" CR ENDOF
99 OF ." This is 99" CR ENDOF
ENDCASE
  
```

This structure provides a much more readable and less errorprone way of making multiple decisions. In the above example, if 99 was the number on the stack, "This is 99" would be printed. Any value other than 8, 12 or 99 would produce no output at all.

For those without the Abersoft version, I'll demonstrate a program to implement the CASE structure in a future article in this series.

CONSTANTS, ARRAYS AND MUCH MORE

Last month I showed you how you can define variables for use in FORTH and explained that the shape in which any number is stored as a variable is part of the dictionary itself. You can see the name of any variable you define by doing a VLIST.

Another useful defining word in FORTH is the word CONSTANT; it is used in the form:

```
number CONSTANT name
```

For example:

```
12 CONSTANT DOZEN
```

Like VARIABLE, CONSTANT sets up space in the dictionary where the number 12 is stored. But in this case, whenever you use the newly defined word DOZEN it is not the memory address of the storage location that is returned, but the contents of the location associated with the word DOZEN. Try it:

```
DOZEN .
```

will produce:

```
12 ok
```

You can use a CONSTANT to store a number that is going to be used often without being changed, and where the program might be clearer if you referred to this number by a name. An example of this might be defining:

```
89 CONSTANT KEY-Y
78 CONSTANT KEY-N
```

so that if you use INKEY to put the ASCII value of a key being pressed onto the stack you could test for key Y being pressed using:

```
BEGIN
INKEY
KEY-Y =
UNTIL
```

instead of the less obvious:

```
BEGIN
INKEY
89 =
UNTIL
```

STORING DEFINITIONS

So far we've seen three different kinds of words defined using : (colon), VARIABLE and CONSTANT. All words created in the dictionary have a similar structure and the principles that govern the creation of a new word allow you to invent your own types of definitions that are very different from the three types we have seen.

Before we can see how to create new definition types it is useful to see how definitions are stored in the dictionary. Each word in the dictionary consists of four basic elements

Name Every word has a name; you can see all the names when you type VLIST.

Link field Every word has a two-byte address called a link field which holds the address of the previously-defined word in the dictionary. This link is used when the dictionary is being searched through.

Code field Every word contains another two-byte address called the code field. This address 'points' to a routine executed whenever the word is used.

Parameter field Almost every word has a 'parameter field'. In the case of variables and constants this field holds the number being stored. For a colon definition this field holds the list of FORTH words that make up the definition. The name, link and code fields have the same format for all FORTH words and can be regarded as a group as the header of the word.

A few diagrams here should clarify the way dictionary entries are stored. Let us assume we have just defined (in the following order) three new definitions for our dictionary:

```
39 VARIABLE BOX
12 CONSTANT DOZEN
: ?DOZENS BOX @ DOZEN / . ;
```

The variable BOX holds a number representing the number of items in a given box.

DOZEN is a constant which holds the number 12.

?DOZENS when executed will print a number representing the number of complete dozens of items that can be taken from the box. In this case ?DOZENS would print '3 ok'.

The way these three definitions are stored is shown in Fig. 4. In this diagram each horizontal line represents two bytes (often referred to as a 'cell') of the dictionary. The first byte of the definition holds the number of letters in the word's name. The next few bytes contain the ASCII codes for the characters in the name. The next two bytes are the link address which points to the previous definition in the dictionary. This is followed by the code field. It is this field that distinguishes a variable from a constant or a colon definition. The address contained in the code field points to a routine which is executed immediately the new word is called. For example, in our definition of BOX the code field points to a routine that will leave the memory address of the 'variable space' on the stack.

In the case of DOZEN the code field points to a routine that will copy onto the top of the stack whatever number is contained in the parameter field.

For ?DOZENS the code pointer points to a routine that will execute the list of FORTH words contained in the definition of ?DOZENS.

The final field in all definitions is the parameter field. For words defined using VARIABLE or CONSTANT the parameter field contains the number that is stored in the variable or constant. The parameter field of a colon definition (like ?DOZENS) contains the addresses of the previously defined words which comprise the definition. Here again is our example of ?DOZENS

```
: ?DOZENS BOX @ DOZEN / . ;
```

When ?DOZENS is executed the definitions that are located at the successive addresses are executed in turn. The mechanism which reads the list of addresses and executes the definitions at each address is called the 'address interpreter'.

It is an important point that when a word like ?DOZENS is being executed the computer does not need to search through the dictionary for the words BOX, @ and so on. The dictionary search is done during compilation and the actual addresses of these words are enclosed in the dictionary

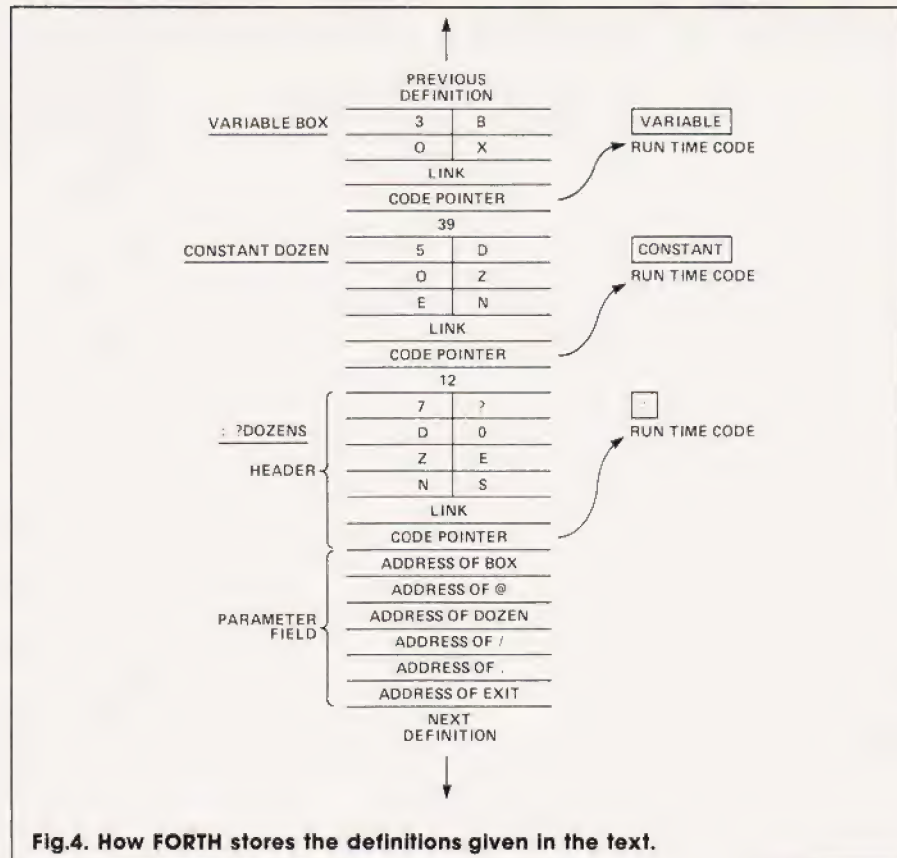


Fig. 4. How FORTH stores the definitions given in the text.

definition of ?DOZENS. This is one of the things that makes FORTH so fast.

The address of a word EXIT is compiled into the parameter field of a colon definition to mark the end of the definition. This word lets the address interpreter 'know' when it has compiled that particular word.

We can see now, in outline at least, what happens during the execution of a colon definition. When you type a word like ?DOZENS, the keyboard interpreter looks for the definition in the dictionary. The code field of the word indicates what needs to be done to execute the definition. In this case the code pointer points to a routine which executes the list of addresses contained in the definition. The first address in ?DOZENS is that of BOX. Before BOX is executed, however, the computer puts the position of the next address in the list onto another stack, called the 'return stack'. This lets the computer 'know' where to come back to once it has finished with BOX. BOX is a variable, so it simply leaves the address of its parameter field on the stack. Execution then returns, using the pointer stored on the return stack, to the next address in the parameter field of ?DOZENS. The next address is that of @ and so @ will be executed next, and so on. This process continues until the EXIT in ?DOZENS, when the

computer 'returns' to the keyboard.

An analogy that might help here is to imagine that you are following a list of instructions for a recipe, but that you don't know what some of the instructions like 'sauté', 'blanch' and so on mean. As you work down your list of instructions you have to leave the recipe to turn to another page where it tells you what to do to sauté something. Before you leave the recipe you make a note (a mental note perhaps) of what page the recipe is on and what instruction you have reached. Thus when you've found out how to sauté, you can return to the main recipe. The place you note your page numbers is your 'return stack' and in some cases the description of, say, sauté might include some other terms of expressions that you will need to find elsewhere in the book.

While it might be tricky for us to keep of what were doing if we can't cook very well and only understand instructions like 'turn gas on', 'stir contents of pan' etc, the computer will keep on 'turning the page' until it finds a definition it can execute directly, ie one in machine code.

We can now see that some of the definitions in the dictionary are defined as machine code instructions. All the other words in the dictionary are then (if somewhat indirectly) defined in terms of these definitions.

BUILDING BLOCKS

Hopefully the explanation of the way definitions are stored will help you understand the way you can create your own 'defining words'. Let's use an example:

```
: CON <BUILDS , DOES> @ ;
```

CON is a defining word which can be regarded in two parts. The first part (<BUILDS ,) creates a new dictionary entry and sets up the name, link and code pointer fields. The second part (DOES>@) decides what the new word does when it is executed, for example:

```
24 CON 2DOZEN
```

The word CON uses its first part, the 'defining part', to set up a new dictionary entry with the name 2DOZEN. The word , (comma) in CON takes the number 24 off the stack and encloses it in the parameter field of the new word. Figure 5 gives a diagrammatic explanation of the dictionary entry.

When 2DOZEN is executed the code pointer points to the second part of the definition of CON. The word DOES > leaves the parameter field address of 2DOZEN on the stack and @ fetches the contents of this address and puts the number on the stack. So now, 2DOZEN (return) will leave 24 on the stack.

Our new word CON behaves just like the defining word CONSTANT. CON can now be used to define any other constant-type definition, such as:

```
13 CON UNLUCKY
21 CON KEY-OF-THE-DOOR
```

Let's try another example.

```
: VAR <BUILDS , DOES> ;
```

Any word that uses <BUILDS-DOES> is a 'defining word'. When it is used like

```
0 VAR AGE
```

it defines a new dictionary entry called AGE. The second part of VAR differs from CON only in that the word @ is missing from the part after DOES >. The word VAR now behaves exactly as VARIABLE. The first part (<BUILDS ,) sets up the dictionary header and the second part (DOES >) simply leaves the parameter field address of, for example, AGE on the stack whenever AGE is used. So:

```
AGE @ .
```

will print:

```
0 ok
```

The first part of a defining word we can refer to as the 'define time action', and the second part as the 'run time action'. Both of these parts can include other FORTH words, and need not necessarily refer to the parameter field of the new word at all. Here's another example.

```
: PRINTLETTER <BUILDS KEY , DOES>
@ EMIT SPACE ;
```

This can be used to define a word such as LETTERF:

```
PRINTLETTER LETTERF (Return)
```

Now press the key F and the computer will respond ok.

The define time action of PRINTLETTER sets up the header for LETTERF, then the word KEY waits for you to press a key. The ASCII code of the key you press is then enclosed in the parameter field of LETTERF, and that is the end of the define time action.

When you now type:

```
LETTERF (Return)
```

the code field of LETTERF points to the run time action of its defining word, ie PRINTLETTER. DOES > puts the parameter field address of LETTERF on the stack, @ fetches the contents of that address and EMIT is a FORTH word that prints the character corresponding to the ASCII code on the stack. SPACE simply prints one space. So now:

```
LETTERF (Return)
```

will produce

```
F ok
```

A defining word like PRINTLETTER can be used to define as many other words as you like, such as:

```
PRINTLETTER LETTERG
```

All words defined using PRINTLETTER behave similarly, they differ only in whatever value was enclosed in the parameter field when they were defined.

As a final example I will show you a defining word which sets up an ARRAY in the dictionary:

```
: ARRAY
<BUILDS 0 DO 0 , LOOP DOES>
;
```

This word can be used to define an array of any number of elements, such as:

```
12 ARRAY MONTHS
```

which will set up an array of 12

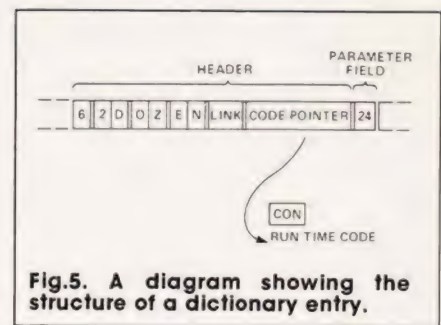


Fig.5. A diagram showing the structure of a dictionary entry.

elements: each element will be initialised to zero when the word is defined. This is done by the expression in ARRAY:

```
0 DO 0 , LOOP
```

Remember there is a 12 on the stack, so a loop is used that counts from zero to twelve and each time round encloses a zero in the dictionary.

When the word MONTHS is used the run time action of ARRAY is only DOES > so only the address of the parameter field is left on the stack and nothing else. This address is the address for the first byte of the array MONTHS. We can use any part of this array as we would use a variable.

```
MONTHS @ .
```

would print the first element of the array.

```
MONTHS 2 + @ .
```

would print the second element of the array as MONTHS 2 + would produce the address of the second element.

```
MONTHS 4 + @ .
```

would print the third element of the array — remember each element occupies two bytes of memory

This definition of an array is cumbersome, as you have to calculate the position of the particular element yourself. It would be handier to say

```
4 MONTHS @
```

if we wanted the contents of the fourth element. Also, the definition does not check if you try to fetch the contents of an element that doesn't exist, for example

```
MONTHS 30 + @
```

for the fifteenth element.

Next month I'll continue with defining words and show you how to define an array-building command that works like DIM in BASIC. We'll also see how to create multi-dimensional arrays and even a 'monsterarray' for holding a monster's attributes in a valley-type game.

SNOWBALL

at £9.90 is a great new adventure for:

BBC 32K COMMODORE 64 SPECTRUM 48K

LYNX 48K NASCOM 32K ORIC 48K ATARI 400/800 32K

Snowball is a massive adventure with over 7000 locations. It took nine months to perfect and marks a new leap forward in adventure games - it has a detailed, planned background and is set aboard a huge starship that would really work. Snowball could be a glimpse of the future!

You play Kim Kimberley, security agent. Your mission is to guard the colony ship Snowball 9 from sabotage.

Thus when your freezer-coffin wakes you with the Snowball still in flight, you know that something must be very wrong. You're weakened and disorientated by lengthy hibernation, but the fate of the 5 mile long space-ship is in your hands!

Snowball is our new fourth adventure. Here's what the reviewers have just said about the first three:

"The Level 9 Adventures are superbly designed and programmed, the contents first rate. The implementation of Colossal Cave is nothing short of brilliant; rush out and buy it. While you're at it, buy their others too. Simply smashing!"

- *SOFT, September 83*

"Of the programs reviewed here, the only one that is wholly admirable is Level 9's Colossal Adventure."

- *Your Computer, September 83*

"I found Dungeon exceedingly well planned and written, with a fast response. There are well over 200 locations and the descriptions are both lengthy and interesting."

- *Computer & Video Games, September 83*

"This has to be the bargain of the year... If adventures are your game, then this is your adventure!"

- *Home Computing Weekly, 30th August 83*

"There are three excellent adventures on offer from Level 9... the descriptions are so good that few players could fail to be ensnared by the realism of the mythical worlds where they are the hero or heroine... great fun to play."

- *Which Micro?, August 83*

MIDDLE EARTH ADVENTURES

for the same micros as Snowball

Each of these games has over 200 locations and a host of puzzles. They can be played singly or together as an impressive trilogy. Each game could well take months to solve!

1) Colossal Adventure

The classical mainframe game "Adventure" with all the original puzzles plus 70 extra rooms.

2) Adventure Quest

An epic puzzle journey in Middle Earth.

3) Dungeon Adventure

Over 100 puzzles to solve as you explore the dungeons left by the Demon Lord - outwitting their guardians.

Price: £9.90 each (inclusive)

Level 9 adventures are available from good computer shops, or mail-order from us at no extra charge. Please send order, or SAE for catalogue, describing your micro to:

LEVEL 9 COMPUTING

Dept C, 229 Hughenden Road,
High Wycombe, Bucks HP13 5PG

Dealer
Enquiries
Welcome

Roger Glanville

VIEWPOINT

If you've been having problems learning to use your brand new micro it may be a comfort to know that you're not alone!

For many months I had been increasingly intrigued by the idea of having a word processor; all those words appearing as if by magic on the screen, that little flashing square shooting all over the place to bring paragraphs from other pages, checking the spelling and inserting names and addresses of people I didn't know into personalised letters. What a fascination! I had to have one.

But could I really justify such a glorified piece of paper and pencil? What could I use it for? I assumed this curiosity would be just a passing fancy and with any luck would finally go away.

However, it didn't go away and as 1982 advanced and we were increasingly bombarded by articles and adverts reminding us that this was IT82 and as I didn't have any other expensive hobbies, no Rolleiflex, no Quad electrostatic speakers, no carbon fibre fishing rod, no Yamaha piano or anything — I finally succumbed!

YOU PAY YOUR MONEY

I bought an Apple II. I have been using it for a fortnight and it's driving me crazy. Is that par for the course? Insanity in two weeks? 'This bloke is nuts,' you must be saying. 'Everyone knows that the Apple is brilliant, so he must be an idiot.'

Well, I can't agree with that. I am just an ordinary sort of fellow, quite bright I reckon, but no computer genius — I still spell program programme. So when the engineer came to install the machine (and take my cheque), out of every box he removed a beautiful piece of hardware and a manual. All the bits of hard and firmware (you see, I'm learning!) he hooked together to give me a system. All the manuals he piled on the desk — to give me 1821 closely printed A5 pages to read!

Undaunted, I started work. My logic had been simple. I couldn't afford a business word processor at anything upwards from two and a half thousand

pounds, I didn't know enough to risk a two hundred quid engineering solder job and I wanted to keep some options open, like using Pilot. So in front of me were manuals for the Apple, Applesoft, DOS, Videx, Zardax, Digitek, Epson, parallel interface, Philips video monitor, VisiCalc and Pilot.

As I had used Pilot before and was familiar with the first few pages of Zardax, I started with the word processing. The disc had been 'set-up', so I booted it. Drive 1 lit up, whirred and stopped. OK. Press 'S' for setup, any other key to continue. Tap the Space bar. Drive 1, red light, whirr, whirr, 10 seconds, 20, 30, 45, 60. Open the manual and read "it takes about 30 seconds to complete the boot process". Look in the DOS manual! "if booting doesn't work, ... re-read the manual carefully — that cures 90% of all problems." It's now two minutes and the disc is still whirring round. Read on: "you'll have to press the RESET key to stop it (normally this is a BAD idea)". I panic. My disc is still going round. Does the bit I have just read mean that it's OK for an uninitialised disc to be stopped with Reset but not for a disc with something written on it? No idea, no option. Press Reset.

I tried the other disc and that worked all right, so I tried the first one again. No joy, press Reset. I carried on working with the back-up, all went well and I was very impressed with the facilities offered by the package and the 80-column screen. After writing some short pieces I turned to the printer. I entered a range of print instructions according to Zardax rules and hardly anything worked properly. Back to the manual. Tucked away in the back flap was a piece of A4 entitled "Errata" and tucked away in that was another instruction. "Simply insert the following line into SETUP." So I entered the Main Menu and looked for the way in. There ain't no way in.

GETTING INTO PRINT

Mike, the engineer who had

installed the machine, explained to me on the phone how to use DOS to list the SETUP program, unlock it, add the required line and BINGO I'd got my print — well, some of my print — instructions to work. Now my interest was aroused. Could I print the Pilot programs I had written at Christmas? I've got a dot matrix printer and it is in Slot 1, so it should work as the Pilot printing arrangements are for a Silentype in Slot 1.

I put the relevant discs in, ran the programs, pressed 'P' for print and waited. One second, click, buzz, silence. Why won't it work? That's not a rhetorical question, by the way. I still don't know the answer, but, and this is the most important point, I don't know why the manuals don't tell me the answer.

Other answers not given in any of the manuals are why the printer, if asked to print something from page 2 of a document, can apparently remember from the top line of page 1 that the right margin is 125 but forgets that it's supposed to be using condensed print and why, if it has been printing double-width characters and is given the single-width instruction, it suddenly slips into the condensed typeface.

The reason underlying this kind of problem seems to be that the hardware and software come from different manufacturers whose primary concern is to match the electronics and make the equipment work. Having done so, they can market their products as being designed for use with a particular system, but each manufacturer then produces a manual for his product and the manuals don't square with each other. A few examples might support my point, because I don't want readers or suppliers to think this is just another of the easily written 'knock the manuals' pieces.

Let's look at the way the manuals deal with the ASCII code. You must remember that since I was looking mainly for word processing facilities in the first instance, I had no idea what the code meant, but I now realise that every damn thing that moves in my system is using it.

The Zardax manual doesn't mention it. All the formatting and printing instructions are given as simple keystrokes, which I think is the best way of doing it since the average Pom likes to know what to press. However, there could be additional reference pages matching the Zardax commands to the ASCII code.

The Epson manual has the direct manner of a Japanese Technical College lecture. It is fairly easy to grasp at the unpacking stage but gets quite complex later. For instance, my printer kept chewing up the paper until I found "Do not lock the release lever" hidden away in a note on page 26. Control codes are given in a form which makes no sense to me, because you can't, sorry, I can't (as far as I can tell) use the ASCII decimal codes for all the instructions to the printer. Even from within a BASIC program a DOS instruction has to have the ESCape bit in CHR\$(n) form followed by a letter or number in quotes. Do I sound like a drowning man? I am certainly out of my depth! I have just been picking bits out of various sample programs (is that better?) and trying them out. Sometimes they work, sometimes they don't.

Apple manuals are generally well thought of, but even in these the ASCII information is inadequate because on page 138 of the **Applesoft reference manual** a neat chart gives just about everything required except the particular bit I need which is the full meaning of each character so that I can match it up to the bits left out of the **Epson Interface Kit manual**.

GRAPHICS OR NOT?

What I have been trying to do is to use Applesoft and DOS commands to gain total control over my printer for the purposes of Zardax. But I have been running into a lot of problems which I am absolutely certain are fairly simple but which I am not trained to solve. Surely the routines could be included in the manuals in keystroke form.

The Videx manual gives some ASCII information, but this time it takes the form of a grid relating the characters to decimal and binary equivalents. How will I ever find out what SOH, ETX, BS, etc mean? BEL I can manage!

Of course, having a Videx card is great for the 80 columns on the screen but adds to the complication slightly by offering alternative methods of obtaining upper/lower case displays. For fun I copied into the Apple the listing of the program Point Symmetry by G W Gallagher (*Computing Today* - May 1982) but as I had the Videoterm card installed I decided to put all the screen instructions in lower case. I can hear from the chuckles that you are all ahead of me again! That left me either with

text and no graphics on the monitor or with reflections in graphics and gobbledygook in text. Yet, I have found no reference to the fact that the lower case instructions would not work.

This idea of using programs published in magazines is very helpful to the slow learner like me. Having established that Mrs Gallagher's printer routine worked with the Epson, although it had been written for the Silentyte, I lifted that bit out and tacked it on the end of another short program, but it wouldn't work. So... back to the manuals to find out what all this POKE - 12528,7 was about. They don't say.

For sound though, you POKE around in the - 16336 area. It says in the Applesoft manual that you can obtain higher notes by increasing the speed of the loops but so far I have only managed to get lower notes. I was impressed to hear the Apple version of Boris Christoff coming from the 2" speaker. Kiri Te Kanawa must be in there somewhere, but she's eluding me at present.

To return to the word processing, however, reminds me that I want a routine for counting the words in an article. I assumed that I could arrive at a good approximation by counting the spaces. Apparently, Zardax stores its texts as textfiles and I have tried retrieving them using the sample programs in the DOS manual. In this venture only partial success can be reported because among

the words on the screen was a load of junk I didn't write; lots of ???s and REENTERS. I don't think I can win with that one.

BUT IN THE END...

The upshot of all this is that I am very happy with the system but very frustrated with some aspects of the manuals. On page one they all talk to me as if I am an absolute beginner; for example, "This manual was in the accessory box. This box should also contain the Apple's power cord (the cord that plugs into the outlet on the wall)." That's a pretty simple start, matched by the Videx approach; "Is the TV monitor turned on? Is it plugged into the power outlet?" and the Zardax introduction, "Zardax is an easy to use Word Processor and Text Editor for the Apple II Plus Computer."

I found all these words helpful, comforting and reassuring when I started. My frustration is that by the time the writer of the manual arrives at the back of his book he thinks he is dealing only with the highly skilled programmer who speaks fluent Hex, assembler and machine language. There must be many others like me who are threshing about in the dark trying in a very hit and miss way to make procedures work.

The guides and reference books cope then with the beginners and the brilliant. What about us average manual workers?



COMPUTAMART

AT A GLANCE...AT A GLANCE...AT A GLANCE...AT A GLANCE...AT A GLANCE...AT A GLANCE...

BERKSHIRE

Micro General **PRINTER SPECIALISTS**
Call for advice on printer selection
Epson & Microline stockists. Interfaces & cables
available for all popular micros.
6 THE BIRCHWOODS, TILFURST, READING.
TEL: 0734 25226

CHESHIRE

northern computers Churchfield Rd.,
Frodsham. Tel: (0928) 35110
Open: 6 days 9-6 Retail and Wholesale. Apple II & IIx,
Atom, BBC, VIC20/64, NewBrain, Dragon 32, Electron,
Spectrum. All accessories. Easy parking off M56.

Computer Junk Shop

We Buy, Sell, Break Computers & Peripherals.
10 Waterloo Rd. Widnes, Halton Tel 051 420 4590

CLEVELAND

BRIERS COMPUTER SERVICES
Polytechnic Bookshop (at the Poly)
1 King Edward Square,
Middlesbrough.
Tel: 0642 242017.
"Everything for the Genie computer"

CORNWALL/DEVON

A. B. & C. COMPUTERS (CT)
Duchy House, 6 Lower Aylmer Sq., St. Austell.
Tel: 0726 64463/67337
Wide range of popular Micros, Printers, books and
accessories. We stock all U need — try us first for
service and competitive prices

PLYMOUTH'S nascom DEALER

S & R BREWSTER LIMITED
86-88 Union St., Plymouth PL1 3HG.
Tel: 0752 665011 Open: 6 days.

DORSET

West Dorsets Nascom Dealer
Business and Personal Computer Systems,
Printers, Software Tel Bridgeport (0308) 56539
Mail Order Service operated
Access/Barclaycard accepted

HERTFORDSHIRE

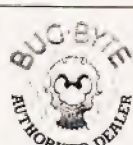
NEWBRAIN SPECIALISTS
HARDWARE & SOFTWARE
Printers, Epson, Shinwa, Juki etc. Monitors, Tape
Recorders, Books, Expansions, CP/M, Mail Order,
Access. 2 new books — see classified ad for details.
ANGELA ENTERPRISES
Tel: Stevenage (0438) 812439 anytime

NORTH KENT

MEDWAY COMPUTERS
141 NEW ROAD, CHATHAM.
Tel: 0634 826080
Open Mon-Sat 10 - 5. Closed Weds.
Most computers and software stocked

LANCASHIRE

LANCASHIRE MICROS
51 QUEEN STREET, MORECAMBE.
Tel: 411435. Also open Sundays.
Singles, Commodore, Acorn, BBC, Dragon,
Authorised dealer for Bug-Byte, Imagine, Quiksalva,
Astor, Midrange House, Sunsoft etc.



**LEIGH COLOUR
LABORATORY LTD**
87 Chapel St., LEIGH.
Tel: 0942 607661
Open: 9 — 5.30.

GREATER MANCHESTER

A & F SOFTWARE
830 HYDE ROAD, MANCHESTER.
Tel: 061 223 6206
Open: Mon-Fri 9.30-5.30 Sat 9.30-5.00
Full range of software/hardware for most
micro computers. Credit cards accepted

N/C COMPUTER SHOPS

29 Hanging Ditch, Manchester.
Tel: 061 832 2269
Open: Mon-Fri 9.30am-5.30pm,
Sat 10-5. Retail and Wholesale.

LINCOLNSHIRE

SHARP CENTRE
16 Melville Street,
Lincoln.
Tel: Lincoln 32379.
Open: 9am-5.30pm closed Wed.

LONDON

HENRY'S COMPUTER SHOP
404-406 Edgware Road, London W2 1ED.
Tel: 01-402 6822
Open: 6 days a week. Order by phone or call
in and see for yourself

BYTESHOP COMPUTERLAND
324 Euston Road, NW1.
Tel: 01-387 0505.
Open: Mon-Fri 9am-5.30pm,
(C.R.A. member)

SOUTH LONDON

CROYDON COMPUTER CENTRE
29a Brigstock Rd., Thornton Heath
Surrey. Tel: 01-689 1280
BBC, Acorn, NewBrain, Genie, Oric,
Kaga, Microvitek, Zenith Monitors, Oki,
80, 82A + 84 Printers, Paper Ribbons,
Software etc. etc. BUY/HIRE

MIDDLESEX

L.B. ELECTRONICS
11 Hercies Rd, Hillingdon.
Tel: Uxbridge 55399 (24hr ans. service)
Open: 6 days, 9.30am-6pm, (lunch 12-15 except Sat)
Surplus equipment, memory, EPROMs etc. Also
established mail order service

NORFOLK

ANGLIA COMPUTER CENTRE
88 St Benedicts Street,
Norwich.
Tel: (0603) 29652/26002.
Open, 6 days 9am-5.30pm.

NORTHAMPTONSHIRE

**NORTHAMPTON
HOME COMPUTER CENTRE**
58A Wellingborough Road, Northampton.
Tel: (0604) 22539
Open: 6 days a week from 10 - 6

NORTHERN IRELAND

NEWBURN Ballycorry
Co. Antrim
Open 6 days a week 10am-6pm. (Sundays 11am-5pm)
All major computer manufacturers' products
including: Apple, Commodore, Dragon, Oric, Olivetti,
Sanyo, Sharp, Shinwa, Zenith, etc.
WHITEHEAD 78330

SCOTLAND

VICTOR MORRIS GLASGOW
TANDY TRS 80, VIC 20, VIDEO GENIE, APPLE
PANASONIC, CUMANA, EPSOM ETC.
340 Argyle Street, Glasgow G2: 041 221 8958

JARAK SOFTWARE CORNER

Copyg. I Print Centre, 98-100 Bath Street
Glasgow G2
Specialists in Software and Peripherals
only. Tel: 041 336 0226

STAFFORDSHIRE

COMPUTER CABIN
24 The Parade, Silverdale, Newcastle.
Tel: 0782 636911
VIC-20, ZX81 hardware and software, BBC Atom,
Spectrum software

COMPUTAMART

AT A GLANCE... AT A GLANCE... AT A GLANCE... AT A GLANCE... AT A GLANCE... AT A GLANCE...

COMPUTING TODAY
PRESENTS YOUR OWN
'WHERE TO BUY IT' GUIDE.

SUSSEX

CROWN
56-58 South Street,
Eastbourne.
Tel: Eastbourne (0323) 639983/20496
Open: 6 days 9am-5.15pm.



GAMER

24 Gloucester Road, Brighton.
Tel: 0273-698424.
Open: Mon-Fri 10am-5.30pm,
Sat 9am-5.30pm.

TYNE AND WEAR

HCCS ASSOCIATES
533 Durham Rd., Low Fell,
Gateshead. Tel. Newcastle 821924.
Open: 6 days 9am-5.30pm (Sat
10am-5.30pm). Specialists in: Acorn,
BBC, Video Genie, VIC 20.

WALES

SIR Computers Ltd.

91 Whitchurch Road, Cardiff.
Tel: 0222 - 21341



STEVE'S COMPUTER COMPANY LTD
CASTLE ARCADE, CARDIFF
Tel: 0222 - 371578
OPEN: Mon - Sat. 9 - 5.30
FOR COMPONENTS TO COMPUTERS

WARWICKSHIRE

OEM MicroCentre

OEM COMPUTER SYSTEMS
9-11 Regent Street, Rugby CV21 2PE.
Tel: (0788) 70522/3/4

THE FINEST COMPUTER SHOWROOMS IN THE MIDLANDS

CARVELLS OF RUGBY LTD

3/7 Bank Street, Rugby CV21 2QE
The Acorn/BBC Specialists

We also stock Texas 1199, VIC 20, Dragon 32,
Commodore 64, Sinclair ZX81, Spectrum, Quc, Atar,
Disk drives, Epson, Juki, Shima & Gushki Printers
and more.
Tel: Rugby 65275/6

LOOKING FOR
MICROCOMPUTER HARDWARE
OR SOFTWARE? LOOK NO
FURTHER THAN
COMPUTAMART!

WARWICKSHIRE

BUSINESS & LEISURE
MICROCOMPUTERS
16 The Square, Kenilworth.
Tel: Kenilworth 512127.

Open: Mon-Fri 9am-5pm. ½ day Thur
(lunch 1-2). Retail and Wholesale.



YORKSHIRE

BRADFORD'S COMPUTER SHOP

at Thomas Wright (Bradford)
Ltd., Thorite House, Laisterdyke.
Tel: Bradford 668890.

Open: Mon-Fri 8.45-5.30. (Sat 12am)

SYSTEM-SOFT

THE BEST FROM THE REST

Freepost, Ackworth, Pontefract WF7 7BR
We stock an excellent range of software from leading
manufacturers for Spectrum, Dragon, Vic 20, BBC
SAE for FREE catalogue Mail Order Only

Please include my business details in the next available issue of Computing Today:

Business Name:

Address:

.....

Tel. No.:

Open Hrs:

Contact (Office Use Only):

Post To: Computamart, Computing Today, 145 Charing Cross Rd., London WC2H 0EE.



Don Thomasson

MAKE A DATE

This is the January issue, so you'll be reading it in December (confusing, isn't it!) and at this time of year our thoughts turn to calendars. Here's a comprehensive piece of programming that should cover most requirements.

Calculation involving dates can be very complicated, because of the varying number of days in a month and the incidence of leap years. The program given here provides a possible solution to the problem. Written in Standard BASIC, it should not be difficult to convert to other BASIC forms. The program begins by setting up the arrays:

MA gives the number of days in each month.

MB gives the number of days in the year before each month.

MC\$ gives the names of the months.

D\$ gives the names of the days of the week.

A menu of three options is then offered, the choice being made by keying in C, M or Y. These function as follows:

C: Date calculations can be performed, the input formats being:

18.7.1919 The date given is set up, and displayed in full, with the day of the week named.

- 4.6.1919 The date given is subtracted from the date which has been set up, and the difference in days is displayed.

+ 500 The number given is added to the set date as a number of days, and the resulting date is displayed. This date becomes the set date.

- 423 The number given is subtracted from the set date as a number of days, and the resulting date is displayed. This date becomes the set date.

E The routine exits to the main menu.

M: Input of a year and a month (the month as a number) will generate a calendar for that month.

Y: Input of a year will generate a calendar for that year with two columns of months side by side.

All this can be done for any year from 1600 AD on. Why 1600

AD? Well, there was a reform of the calendar in the sixteenth century, and it seemed easier to dodge the need to cope with this. (Coward! Ed. Agreed. DWT)

CALCULATION MODE

The calculation mode is handled by lines 400-680. When the input has been made, an 'E' results in return to the menu at 220. Otherwise, the P or L flag is set if the input starts with a + or - sign. The input is then scanned character by character, and the numerics are assembled in E\$. When a full stop is found, the currently assembled number is set in a variable, the value of F determining whether the variable should be Y, M, D or N, the latter applying when no full stops are found.

If the input is a date, subroutine 1000 is called at line 560 to calculate a 'base number' for the given year, taking 1st January 1600 as 1. The number of subsequent years is multiplied by 365, and corrections are then applied for the intervening leap years: one is added for each year divisible by four; one is subtracted for each year divisible by 100 (not a leap year); and one is added for each year divisible by 400, starting with 1600.

Some points regarding this routine need comment. The 'ABS' functions are included because for the year 1600 the overall terms would otherwise give -1. The two terms would cancel each other out, as matters stand, but it seemed worth drawing attention to the point. The figure subtracted is 1601, not 1600, because the effect of a leap year does not show until the start of the subsequent year. In line 1020 a value of 1201 is subtracted, because 1600 itself is a leap year, and 1 must be added to the base for 1601.

The base number for the given day is then set in N by adding MB(M) and D to the year base

CALENDAR FOR 1982

January							February						
SUN	MON	TUE	WED	THU	FRI	SAT	SUN	MON	TUE	WED	THU	FRI	SAT
3	4	5	6	7	8	9	1	2	3	4	5	6	7
10	11	12	13	14	15	16	8	9	10	11	12	13	14
17	18	19	20	21	22	23	15	16	17	18	19	20	21
24	25	26	27	28	29	30	22	23	24	25	26	27	28
31													

March							April						
SUN	MON	TUE	WED	THU	FRI	SAT	SUN	MON	TUE	WED	THU	FRI	SAT
1	2	3	4	5	6	7	1	2	3	4	5	6	7
8	9	10	11	12	13	14	8	9	10	11	12	13	14
15	16	17	18	19	20	21	15	16	17	18	19	20	21
22	23	24	25	26	27	28	22	23	24	25	26	27	28
29	30	31					29	30	1	2	3	4	5

May							June						
SUN	MON	TUE	WED	THU	FRI	SAT	SUN	MON	TUE	WED	THU	FRI	SAT
1	2	3	4	5	6	7	1	2	3	4	5	6	7
8	9	10	11	12	13	14	8	9	10	11	12	13	14
15	16	17	18	19	20	21	15	16	17	18	19	20	21
22	23	24	25	26	27	28	22	23	24	25	26	27	28
29	30	31					29	30	1	2	3	4	5

July							August						
SUN	MON	TUE	WED	THU	FRI	SAT	SUN	MON	TUE	WED	THU	FRI	SAT
1	2	3	4	5	6	7	1	2	3	4	5	6	7
8	9	10	11	12	13	14	8	9	10	11	12	13	14
15	16	17	18	19	20	21	15	16	17	18	19	20	21
22	23	24	25	26	27	28	22	23	24	25	26	27	28
29	30	31					29	30	1	2	3	4	5

September							October						
SUN	MON	TUE	WED	THU	FRI	SAT	SUN	MON	TUE	WED	THU	FRI	SAT
1	2	3	4	5	6	7	1	2	3	4	5	6	7
8	9	10	11	12	13	14	8	9	10	11	12	13	14
15	16	17	18	19	20	21	15	16	17	18	19	20	21
22	23	24	25	26	27	28	22	23	24	25	26	27	28
29	30						29	30	1	2	3	4	5

November							December						
SUN	MON	TUE	WED	THU	FRI	SAT	SUN	MON	TUE	WED	THU	FRI	SAT
1	2	3	4	5	6	7	1	2	3	4	5	6	7
8	9	10	11	12	13	14	8	9	10	11	12	13	14
15	16	17	18	19	20	21	15	16	17	18	19	20	21
22	23	24	25	26	27	28	22	23	24	25	26	27	28
29	30						29	30	1	2	3	4	5

number. Subroutine 1100 is called to set YL = 1 if the current year is a leap year, and YL is added to N if M > 2, ie if the month is March or later, when the effect of the extra day in February must be taken into account.

Any arithmetic indicated by the flags P and L is then carried out, using MA to contain the set value. Otherwise NA is set from N. If a date has been subtracted, L = 1 and F = 2, in which case N is displayed. Otherwise, the date corresponding to N is displayed. Purists could extend this to report errors for illegal operations, such as adding two dates together.

DATE CALCULATION

Deriving N from a given date is fairly painless, but the reverse process, carried out by subroutine 1200, is more difficult. One program used a loop to check off each year individually until the total matched N. Here, an approximation is first made by dividing N by 365.25. This will usually give the correct year, but not for all dates. For instance, 1.1.1982 gives 1981 with a remainder of 366 days. As 1981 was not a leap year, this is detected as an error by line 1240, the year is incremented and the surplus days recalculated as 1.

The correct month is then identified by reference to array MB, not forgetting to add 1 for March onward in leap years. An iterative loop seemed permissible here.

Finally, the day of the month is found and the original value of N is restored from NH.

MONTH CALENDAR

The month calendar routine at 3000 is fairly straightforward. Once the year and month have been input, two parameters determine

the printout.

BA is set from MA(M) to the number of days in the month, YL being added for March onward. The process continues until BA days have been entered. The value of N for the 1st of the month is calculated, and GA is set to (N+5) modulo 7. This indicates the day of the week on which the month starts, and the printout of each numeral is positioned by tabbing 4*GA columns. The extra term in the tab bracket, -(W<10), adds another space for numbers less than 10, obtaining right justification.

As printing proceeds, GA is incremented modulo 7, and this ensures continued correct positioning of the numbers.

YEAR CALENDAR

The year calendar program is more

complex. Because two month calendars are printed side by side, BA and GA have to be duplicated, and arrangements must be made to cater for either of the two months occupying fewer lines. The principle is otherwise the same as that used for the single month output.

No provision has been made for switching the calendar outputs to a printer, because that will vary with each type of machine. Where LPRINT is available, there is no problem.

CODING

There are a number of places where some slightly fancy coding would reduce the program length, but the objective was to avoid obscurity. The conditional addition of YL, for example, could have been achieved by -(M>2)*YL,

rather than by an IF-THEN statement. Elsewhere, BA could have been replaced by MA(R), BB by MA(R+1), but the use of the copied variable seems to assist clarity. Those who value space saving more than program clarity can easily make the necessary changes.

Thanks to the rude comments of colleagues, most of the potential snags and errors seem to have been ironed out. There has been some argument regarding the date of introduction of the '400 year' rule, but if it was after 1600 AD only the first two months of 1600 are affected. Some similar programs have had much more blatant errors.

Extension of the program to cover biorhythms should be fairly simple, but at the age of 23055 days mine are fading too much to be of great significance!

```

100 DIM MA(13),MB(13),MC(12)
110 FOR X = 1 TO 13
120 READ MA(X):READ MB(X)
130 NEXT X
140 FOR X = 0 TO 6:READ D$(X):NEXT X
150 FOR X = 1 TO 12:READ MC$(X):NEXT X
199 REM .....Main Menu
200 PRINTCHR$(12)
210 PRINT "MAKE A DATE":PRINT:PRINT
220 PRINT "To create a year calendar, type 'Y'."
230 PRINT "To create a month calendar, type 'M'."
240 PRINT "To calculate dates, type 'C'."
250 A$=""
260 INPUT A$
270 IF A$ = "C" THEN 400
280 IF A$ = "Y" THEN 2000
290 IF A$ = "M" THEN 3000
300 PRINT "Try again...":GOTO 250
399 REM .....Calculation Routine
400 P = 0:L = 0
410 INPUT ">";A$
420 IF A$="E" THEN 220
430 IF LEFT$(A$,1) = "+" THEN P=1
440 IF LEFT$(A$,1) = "-" THEN L=1
450 E$ = "":F = 0
460 FOR X = 1 TO LEN(A$):B$ = MID$(A$,X,1)
470 IF ASC(B$) > 47 AND ASC(B$) < 58 THEN E$=E$+B$
480 IF B$ <> "." THEN 520
490 F = F + 1
500 IF F=1 THEN D = VAL(E$):E$=""
510 IF F=2 THEN M = VAL(E$):E$=""
520 NEXT X
530 IF F = 0 THEN N = VAL(E$):E$=""
540 IF F > 2 THEN 590
550 Y = VAL(E$):E$=""
560 GOSUB 1000
570 N = N+MB(M) + D
580 GOSUB 1100:IF M>2 THEN N=N+YL
590 IF P=1 THEN NA = NA + N:GOTO 620
600 IF L=1 THEN NA = NA - N:GOTO 620
610 NA = N
620 N = NA
630 IF F=2 AND L=1 THEN 670
640 GOSUB 1200
650 G = N+5 - 7*INT((N+5)/7)
660 PRINT TAB(20) D$(G) D;MC$(M);Y
670 IF (P=1 OR L=1) AND F>0 THEN PRINT TAB(30) N
680 GOTO 400
999 REM ..... Calculate Year Base
1000 N=365*(Y-1600)
1010 N=N+INT((ABS(Y-1601)/4) - INT(ABS(Y-1601)/100))
1020 N=N+INT((Y-1201)/400)
1030 RETURN
1099 REM .....Identify Leap Years
1100 YL = 0
1110 IF (INT(Y/4) = Y/4) AND (INT(Y/100)<>Y/100) THEN YL=1
1120 IF INT(Y/400) = Y/400 THEN YL=1
1130 RETURN
1199 REM ..... Calculate Date
1200 Y = INT(N/365.25) + 1600:NH = N
1210 GOSUB 1000
1220 DF = NH - N
1230 GOSUB 1100
1240 IF DF > 365 + YL THEN Y = Y + 1:GOTO 1210
1250 IF DF < 1 THEN Y = Y - 1:GOTO 1210

1260 X=1
1270 DK = MB(X+1):IF YL = 1 AND X>1 THEN DK=DK+1
1280 IF DF > DK THEN X = X + 1: GOTO 1270
1290 M = X
1300 D = DF - MB(X):IF X>2 THEN D = D - YL
1310 N = NH
1320 RETURN
1999 REM .....Year Calendar
2000 INPUT "Year";Y:D=1:M=1
2010 PRINT CHR$(12):PRINT "CALENDAR FOR" Y
2020 FOR R = 1 TO 12 STEP 2
2030 PRINT:PRINT MC$(R);:PRINT TAB(30) MC$(R+1):PRINT
2040 PRINT "SUN MON TUE WED THU FRI SAT";
2050 PRINT TAB(30) "SUN MON TUE WED THU FRI SAT"
2060 GOSUB 1100
2070 BA = MA(R):BB = MA(R+1)
2080 IF R = 1 THEN BB = BB + YL
2090 GOSUB 1000: N = N + MB(R) + 1
2100 IF R>1 THEN N=N+YL
2110 GA = N+5-7*INT((N+5)/7)
2120 GOSUB 1000: N = N + MB(R+1) + 1
2130 IF R>1 THEN N=N+YL
2140 GB = N+5-7*INT((N+5)/7)
2150 W=1:Z=1
2160 IF W>BA AND Z>BB THEN 2290
2170 IF W>BA THEN 2270
2180 PRINT TAB(4*GA-(W<10)) W;
2190 W=W+1
2200 GA = GA+1:IF GA>6 THEN GA = 0:GOTO 2220
2210 GOTO 2160
2220 IF Z>BB THEN PRINT:GOTO 2160
2240 PRINT TAB(30+4*GB-(Z<10)) Z;
2250 Z=Z+1
2260 GB=GB+1:IF GB>6 THEN GB=0:PRINT:GOTO 2160
2270 IF Z>BB THEN PRINT:GOTO 2160
2280 GOTO 2220
2290 PRINT:NEXT R
2300 INPUT G:GOTO 220
2999 REM .....Month Calendar
3000 INPUT "Year";Y
3010 INPUT "Month";M
3020 PRINT CHR$(12):PRINT:PRINT MC$(M);" Y
3030 PRINT:PRINT "SUN MON TUE WED THU FRI SAT
3040 GOSUB 1100
3050 BA = MA(M):IF M=2 THEN BA = BA+YL
3060 GOSUB 1000
3070 N = N+MB(M) + 1
3080 IF M>2 THEN N=N+YL
3090 GA = N+5 - 7*INT((N+5)/7)
3100 W=1
3110 IF W>BA THEN 3190
3120 PRINT TAB(4*GA-(W<10)) W;
3130 W=W+1
3140 GA = GA+1:IF GA > 6 THEN GA=0:PRINT
3150 GOTO 3110
3190 PRINT:PRINT:PRINT
3200 INPUT G:GOTO 220
4000 DATA 31,0,28,31,31,59,30,90,31,120,30,151
4010 DATA 31,181,31,212,30,243,31,273,30,304,31,334,0,365
4020 DATA Sunday,Monday,Tuesday,Wednesday,Thursday
4025 DATA Friday,Saturday
4030 DATA January,February,March,April,May,June
4040 DATA July,August,September,October,November,December
READY

```


LUCAS LX

MEMORY 64K RAM expandable to 256K
LANGUAGE Microsoft BASIC
CASSETTE 300 or 1200 baud
DISC Single or twin 5 1/4 floppy disc drives
 DOS CP/M 2.2 (supplied) or NAS-DOS
KEYBOARD QWERTY ☒ CURSOR ☒ NUMERIC ☒ FUNCT ☒
DISPLAY TV ☒ MONITOR ☒ SUPPLIED ☒
INTERFACE PARA ☒ SERIAL ☒ BUS ☒
GRAPHICS BLOCK ☒ USER ☒
 LINE ☐ RES 392 by 256
 COLOUR 8 TEXT 80 by 25

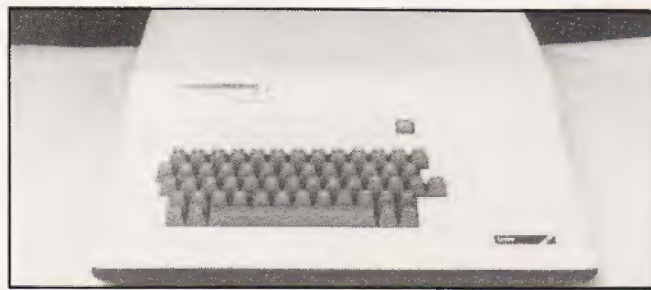
Notes. The Lucas LX is a Z80 microcomputer aimed more at the professional and business user. Hence 5M Winchester disc interfacing is provided. Popular printers may be used with the RS232 serial interface, and a Centronics interface is also provided. There is an additional parallel interface connector for providing up to 16 on/off signals. The monitor supplied as standard is a 12" monochrome version: a colour monitor is also available. The high res colour graphics may be 392 by 256 in eight colours, or 784 by 256 in two colours. A wide range of applications software is available via the CP/M operating system, including Wordstar, Supercalc, and Calcstar.



NASCOM 3

MEMORY 48K RAM 10K ROM
LANGUAGE Microsoft BASIC
CASSETTE 300 or 1200 baud
DISC extra DOS CP/M or NAS-DOS
KEYBOARD QWERTY ☒ CURSOR ☒ NUMERIC ☒ FUNCT ☒
DISPLAY TV ☒ MONITOR ☒ SUPPLIED ☒
INTERFACE PARA ☒ SERIAL ☒ BUS ☒
GRAPHICS BLOCK ☒ USER ☒
 LINE ☐ RES 800 by 256
 COLOUR 8 TEXT 25 by 80
SOUND Three channels

Notes. The Nascom 3 is a Z80 based micro. A second version of BASIC and Pascal are also available, as are a cassette recorder and light pen.



BERKSHIRE

Kuma Computers Limited

Fully support with software and hardware. Sharp 700, Sharp MZ80A and MZ80B, 11 York Road, Maidenhead, Berks. Phone for details — 0628 71778

COMPUTER 100

181 Oxford House, Reading, Berks RG1 7UZ
 TEL: 0734 591616

One of the UK's largest stockists

CAMBRIDGESHIRE

MS CONSULTANTS (CAMBRIDGE) LTD

152 High Street, Huntingdon, PE18 6TF. Tel: 0480 51721
 Specialists in Sharp Hardware & Software

LANCASHIRE

Sumita 12-14 Avenham St. Preston (0772) 51688

Sharp MZ-3541 Based Software, Bakehouse Orders System, Barstock System
SALES — SERVICE SOFTWARE

BAR INSTRUMENT CO. LTD.

For Sharp computers, books, software
Urmston Computer Centre,
 124 Flixton Road, Urmston, Manchester.
 Tel: 061 - 747 4626

MICRO APPLICATION PACKAGES LTD.

Wild Oaks Drive, Thornton, Blackpool FY5 5BR. Tel: 0253 866464
 Specialize in Business Programs for the Sharp MZ 3500 Machine Estimating, Job Costing, Retail Stock Control, Also Graphics/Drafting Package
 Suitable CAD/CAM use

ELKAN ELECTRONICS

11, Bury New Road, Prestwich Manchester M25 8JZ.
 Telephone 061-798 7613 (24hrs & Mail Order)

Pocket computer software and hardware
 Phone/write for the new Elkan File now

LINCOLNSHIRE

SHARP CENTRE

16 Melville Street, Lincoln. Tel: Lincoln 32379

All Sharp Microcomputers. Specialists in Industrial Process Control Systems. Customers include British Telecom, M.O.D. CRA & CTA Members

LONDON

MICROS FOR MANAGERS
 149 Gloucester Rd., London SW7 4TH
 Pocket Computer Software Specialists. APD air conditioning/heating/ventilation design package £25 (for Sharp PC1251 & PC1211). Applications written for you. Wholesale/Retail — Trade enquiries welcome Tel: 01-370 5125 for appointment.

LONDON

SHARPSOFT LTD.

With the Sharp user in mind. For the keenest prices on hardware or full range of software contact the Sharp Computer Specialists.

Sharpssoft Ltd, Crisallen House, 86-90 Paul Street, London EC2. Tel: 01 - 729 5588.

MIDLANDS

JAXREST LTD

Linton House, Catherine Street, Aston, Birmingham.
 Tel: 021 328 0543

Sharp Service and Support

NORFOLK

GRASSROOT COMPUTERS

25 Wellington Rd., Dereham. TEL: 0362 4640

Specialist in small business computing. Send for details of stockbox — the complete and thorough stock system with 2500 items per disc. Other modules to follow.

SCOTLAND

micro change ltd

Telford House, 74 Miller St., Glasgow. TEL: 041 204 1929

SHARP ALTOS SUPERBRAIN
 Call us for your software and hardware requirements — We will tailor our data base to meet these

LOWDATA SYSTEMS

A division of Lowson Bros & Co (Engineers Ltd) PO Box 53, Blackness Road Dundee DD1 9JG
 Tel: (0382) 22314

Full range of Sharp Equipment stocked

STAFFORDSHIRE

COMPUTER DISTRIBUTORS DISCOS LTD.

East Cannock Road, Hednesford, Staffs WS11 5LT. Tel: Hednesford (05438) 2021-3
 MZ 3541 Business Computers, Peachtree Business Software, Financial Director Accounts Package, MZ 700 Wholesalers

WALES

STEVE'S COMPUTER COMPANY LTD
 CASTLE ARCADE, CARDIFF.

Tel: 0222 — 371578

OPEN: Mon — Sat 9 - 5.30
 For Components to Computers

WEST SUSSEX

MICROCENTRE LTD.

SYSTEMS, SOFTWARE SERVICE, SUPPORT

28-30 Station Road, Bognor Regis, Sussex. TEL: 0243 827779

YORKSHIRE

PROGRAM 1

For Business Software
 35 Albion Street, Hull. TEL: 0482 20022

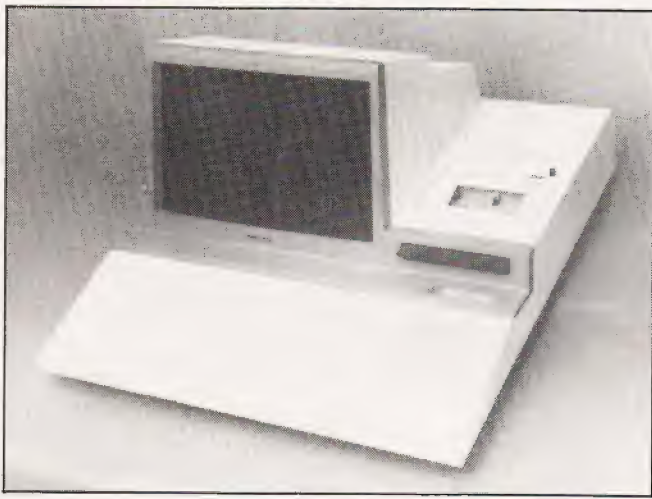
SHARP

MICRODEALER

SHARP MZ-80A

MEMORY	48K RAM	4K ROM
LANGUAGE	Microsoft BASIC	
CASSETTE	1200 baud (built-in)	
DISC	extra	DOS
KEYBOARD	QWERTY	CURSOR
DISPLAY	TV	MONITOR
INTERFACE	PARA	SERIAL
GRAPHICS	BLOCK	USER
	LINE	RES 80 by 50
	COLOUR	TEXT 25 by 40
SOUND	Single channel	

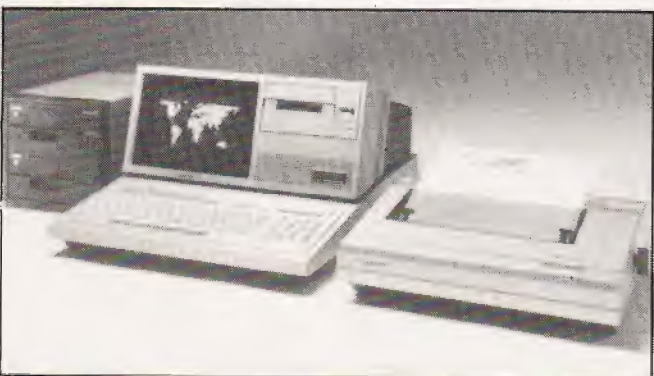
Notes: The Sharp MZ-80A is a Z80 based micro. An expansion unit, printer, floppy disc unit and other peripherals are available. Other languages can also be used such as Pascal merely by replacing the tape. With the floppy disc option the machine can respond to higher level software such as Disc BASIC and FDOS (including BASIC compiler). A small range of business and educational software is available. The supplier is **Sharp Electronics (UK) Ltd**, Thorp Road, Newton Heath, Manchester M10 9BE.



SHARP MZ-80B

MEMORY	64K RAM	2K ROM
LANGUAGE	BASIC (on tape)	
CASSETTE	1800 baud built-in	
DISC	extra	DOS
KEYBOARD	QWERTY	CURSOR
DISPLAY	TV	MONITOR
INTERFACE	PARA	SERIAL
GRAPHICS	BLOCK	USER
	LINE	RES 320 by 300
	COLOUR	TEXT 25 by 80
SOUND	3 channels	

Notes: The Sharp MZ-80B is a Z80A based micro. Various other languages can be loaded as the machine is "soft", no language being fitted in ROM. Expansion unit, the MZ-80PS printer and the MZ-80PB floppy disc drive are also available. The supplier is **Sharp Electronics (UK) Ltd**, Thorp Road, Newton Heath, Manchester.



AVON

MicroValue

TARGET ELECTRONICS LTD
16 Cherry Lane, Bristol.
Tel: (0272) 421196

80-BUS SOLUTIONS

LONDON

MicroValue

HENRY'S RADIO
404 Edgware Road, London W2.
Tel: 01-402 6822

80-BUS SOLUTIONS

BUCKS

MicroValue

AMERSHAM COMPUTER CENTRE
18 Woodside Road, Amersham, Bucks.
Tel: (2403) 22307

80-BUS SOLUTIONS

NORTHERN IRELAND

NEWBURN

BALLYCARRY CO ANTRIM
6 days until 8 pm. Gemini, Galaxy, Nascom, Acorn Computers, Discs, monitors, printers servicing, hire, Industrial Control Accounts, Word Processors
WHITEHEAD 78330

DEVON

PLYMOUTH'S DEALER

nascom
S & R BREWSTER LIMITED
86-88 Union Street, Plymouth PL1 3HG
Tel: 0752 665011 Open: 6 days

NOTTINGHAMSHIRE

MicroValue

COMPUTERAMA, (Skytronics Ltd.)
357 Derby Road, Nottingham
Tel: (0602) 781742

80-BUS SOLUTIONS

DORSET

PARKSTONE COMPUTER SYSTEMS
Main Nascom Dealer & Service Centre
Also Dealers for Gemini, Transec, Genie

18 Station Road, Lower Parkstone,
Poole, Dorset BH14 8UB.
Tel: PARKSTONE (0202) 746555

SUFFOLK

M. D. W. ELECTRONICS

47 Woodbridge Rd. East, Ipswich
IP4 5QN.
Tel: (0473) 78295
Nascom, Nasbus, Gemini Multi-board Stockists

SURREY

MicroValue

ELECTROVALUE LTD
28 St. Jude's Rd, Englefield Gt, Egham,
Surrey. Tel: (07843) 3603

80-BUS SOLUTIONS

ZIPPY ELECTRONICS

West Dorsets Nascom Dealer
Business and Personal Computer
Systems, Printers, Software. Tel:
Bridport (0308) 56539
Mail Order Service operated.
Access/Barclaycard accepted.

HUMBERSIDE

TOMORROWS WORLD

The sole Nascom Agent for North
Humberside
15 Paragon Street, Hull HU1 3NA.
TEL: 0482 24887

WALES

BYTE-RITE

Llandaff R & TV Ltd, 24-26 High St.,
Llandaff, Cardiff. Tel: 0222 563760
Nascom, Gemini, Lucas Logic, C.A.U.
Networks, Dragon Peripherals.

LANCASHIRE

MicroValue

EV COMPUTING
700 Burnage Lane, Manchester M19.
Tel: 061-431 4866

80-BUS SOLUTIONS

WARWICKSHIRE

BUSINESS & LEISURE MICROCOMPUTERS

16 The Square, Kenilworth,
Warwickshire CV8 1EB
Tel: 0926 512127
We are the largest Lucas Nascom
dealer in the UK and carry the greatest
variety of products for this range of
computers.

LONDON

MicroValue

OFFRECORDS
Computer House, 58 Battersea Rise,
Clapham Junction. Tel: 01-223 7730

80-BUS SOLUTIONS

YORKSHIRE

MicroValue

LEEDS COMPUTER CENTRE
55 Wade Lane, Merlion Centre, Leeds.
Tel: (0532) 458877

80-BUS SOLUTIONS

COMPUTING TODAY

Lineage: 35p per word.

Semi display: £8.00 per single column centimetre
Ring for information on series bookings/discounts.

All advertisements in this section must be prepaid.
Advertisements are accepted subject to the terms and conditions printed on the advertisement rate card (available on request).



**01-437 1002
EXT 305**

Send your requirements to:
MARK BECAREVIC
ASP LTD, 145 Charing Cross Road,
London WC2H 0EE.

ADD-ONS

NASCOM

COLOUR DISTEL Information Display Executive £9.95 inc.
Enhanced version controls colour via the PIO and simple interface. DISTEL is an advanced program for control of dynamic teletext type displays with simple keyboard commands for five fonts, pauses, speed changes, blanking borders, special graphics, overlaying for animation, mimic diagrams and scrolling announcements. Paging system for replaying in any order. Ideal for advertising, lecturing or creative amusement.

ANIMEX Animation Executive £7.95 inc.
Fast machine code program for frame animation. Generate partial images with Edifis for rapid composition. Cartoon examples supplied on tape.

EDIFIS Editor for images £9.95 inc.
3K machine code image composition program for high res. characters of pixel images for DISTEL and ANIMEX. Comprehensive commands for translations, mirror, logical combinations, fill, multiple scale etc.

ALL PROGRAMS ON HIGH QUALITY TAPE WITH FULL HANDBOOKS

24HR VISA/ACCESS Service

Tel: 031-552-7501/2

A.D.D. Ltd, 50 West Harbour Rd.,
Edinburgh EH5 1PU

ANIMATION GRAPHICS BOARD FOR NASBUS/280 BUS SYSTEMS

11 1/2" x 8" PCB WITH NASBUS EDGE
CONNECTOR CONTAINING:

- Video Display Processor TMS 9928A/29A • 16K screen RAM driven by the VDP chip • 256 x 192 pixel resolution in 16 colours • Backdrop, pattern plane and 32 'Sprite' planes • 32 'Sprites' 8 x 8, 16 x 16 or 32 x 32 pixel objects • Sprites magnified by bit in VDP registers • X,Y co-ordinates set by two bytes/sprite • 3D 'Eclipse' effect of sprite super-imposition • coincidence flag detects sprite collisions • 8 channel 8 bit A-D on board (joysticks etc.) • Twin sound generators for stereo sound • 2K Bytes C-Mos battery backed up RAM for non volatile storage • Choice of 2 real time clocks • calendar • CTC for sound generator programming and timing functions • All functions mapped as i/o ports

PCB, i/o decode prom, construction manual, 60 page software manual, tape with test and demonstration software all for £33.80 - £1.75 post and package. Colour difference Matrix Board for linear and TTL monitors PCB £8.80 + 50p post and package.

TANELORN SYSTEMS

Bank End, Mickethwaite, Bingley,
West Yorkshire BD16 3JR 0274 568380

CHILTERN ELECTRONICS THE MONITOR SPECIALISTS

Amazing Value in Video Monitors
Professional quality equipment by AGC Corp ideal for your micro. Look at these features: • Superb resolution for graphics, 80 col etc • Bandwidth 10Hz-22MHz • Green Screen P31 phosphor • Antiglare tube • Attractively styled case • Composite video main operation Available in 9" Model HM911 £85, 12" Model HM123 £89.

FANTASTIC KEYBOARD BARGAIN!!
Scoop purchase allows us to offer a 49 key QWERTY layout, ASCII encoded keyboard. Fully cased, used but guaranteed working. Full logic diagrams and information supplied **ONLY £15**. Add carriage £1.85 and VAT. Educational discounts. Access welcome. Same day despatch. Call Gary Kent on 02407 71234 High Street, Chalfont St Giles, Bucks HP8 4HQ. Telex: 262224.

PET CONVERSIONS AND UPGRADES

It's here at new LOW low price!!
Don't throw out your old 9" PET
The micro port 80 column conversion board for the 9" PET/CBM basic 4.0 or upgrade 2001/3000 series machines will upgrade it to a true 8000 series. Simply plugs into the main logic board, and with a small keyboard modification turns your PET into an 8032 Compatible with any 8032 software and ROM facilities. Supplied complete with full fitting instructions, or fitted free of charge at our workshops. Full money back guarantee within 14 days if not delighted. £125.00
Externally mounted switching unit for above (40/80 column suitable). £15.00
12" VDU (FAT 40) 8 column conversion £82.00
40/80 column switchable (two machines in one). £96.00
Full keyboard functions i.e. TAB, ESC, REPEAT, SCROLL, up/down, DEFINE, WINDOW, LOWER CASE/GRAPHIC MODE AND DELETE ROM/2 'Cursor'. All available in direct or program mode. Any micro port converted machine is also upgradable to 8086 specification with our 64K add on board £250.00

MEMORY UPGRADES WHILE-U-WAIT conversion (Dynamic RAM PETS only) Memory expansion 8K-32K £53.00, 16K-32K from £43.00, 8K-16K £34.40

CBM 64 QUALITY SOFTWARE

If you own a PET system with disk or printer and have added a Commodore 64, then why not use your PET as an interface for the 64? SIPOD is a IEEE to parallel IEEE interface allowing you to use all the PET's disk drives, printer, plotters, modems etc. directly from the 64. No memory space is consumed within the 64 as SIPOD loads and executes within the PET. SIPOD is supplied complete with interface, lead and instructions. £29.00

Prepaid orders are post free.
Telephone Mick Bignall for details for any of the above at Microport, 7 Clydesdale Close, Boreham, Heris WD6 2SD. Tel: 01-953 8385.

Microtan 65 Eprom Switching Board

Permit any 4 from 16 Software controlled Bareboards + instructions £19.95 post free. Also available 64 x 25 colour VDU card, 3 pass assembler, word processor etc. Large SAE for details.

M.P.D., 7 Cedar Close,
Graham, Huntingdon
PE18 0DZ.

SOFTWARE LANGUAGES

FORTH AVAILABLE NOW

Nas-FORTH 1.11 for Nascom 2 etc.
Fig-FORTH with FORTH-79 additions. Complete with ZX80 assembler and screen editor. Ram-Disc simulation, stack display utility, full support of Nas-sys routines. Extensive manual, full system 9K on tape £25 + VAT.
PET FORTH 1.11 for 4000 and 8000 series. Fig-FORTH with FORTH-79 additions. Complete with 6502 assembler and screen editor. Ram-Disc simulation for tape version. Stack display utility. Powerful IEEE control words. Extensive manual. Tape version £25.00 + VAT. Disc version including tutorial disc £75.00 + VAT.

x-FORTH for CPM systems.
FORTH-79 for all 280 CPM systems. Extensive manual. All above features and more £75.00 + VAT including tutorial disc.

Purchase of our products includes free membership of xFORTH Users Group and FORTH tutorial disc or tape. Purchase price includes multiple copies. Full range of FORTH books available.

Write or telephone for more details
0202 764724

David Husband,

2 Gorseford Road, Branksome, Poole,
Dorset BH12 1NW

GO FORTH & * ;

DIY FORTH KITS
Installation manual £7.00
How to do it + (code) + definition + editor
Source code using 8080 processor £7.00
8080 8080 8080 8080 £6.00
8080 1600 8080 2500 VAX Apple II
CPM111111

JUPITER ACE — a very nice FORTH micro
now with free Rampack. £78.00 + VAT

FULL FORTHS ON CASSETTE Spectrum
48L in editor colour sound £14.95
8080 + editor assembler graphics 8080
Dragon 32 + editor graphics commands
..... £18.95



MicroProcessor Engineering Ltd
21 Hanley Road, Solihull
Solutions 501 0AP
Tel: 0562 775402

LIBRARIES

THE MZ80K/A SOFTWARE LIBRARY

Choose from 150 titles. These include exciting Arcade/Adventure games and Educational/Business applications. Once only membership fee £5.00. Hire charges only 90p per 14 day period. Plus your first 5 games FREE. Send now for free illustrated catalogue to:

The Yorkshire Software Library,
13 Park Top, Pudsey,
Yorkshire LS28 6BY.

CARTRIDGE CITY will rent Atari 400 and 800 owners cartridges at low rates. Discounts on software purchases. Details from Cartridge City, 25 Gaitside Drive, Aberdeen AB1 7BH.

SERVICES

ELIMINATE FAULTY CASSETTES

DataClone is the first company in the UK established specifically for the duplication of data cassettes.

All other duplicating houses are audio orientated — only DataClone has a duplicating system designed from scratch purely to handle computer information.

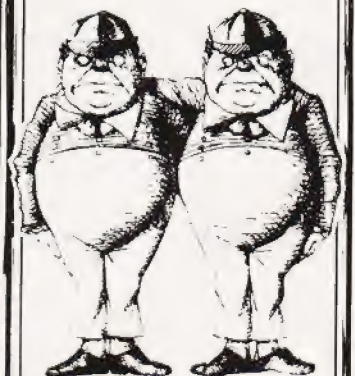
The result?

Greatly improved reliability in data transfer rates from 300 to beyond 2400 baud — previously unattainable.

All formats catered for. Quantities from 100 to infinity.

Contact us now for brochure.

DataClone — the first specialist service for computer cassettes



DATACLONE

Unit 1, Roslin Square, Roslin Rd.,
Acton, London W3.
Tek 01-723 0477 Telex: 21879

OFFERING A SERVICE?

PHONE ASP CLASSIFIED

**01 - 437 1002
EXT 305**

SOFTWARE APPLICATIONS

WHICH TAPE COPIER?

Only two can copy ALL Spectrum programs and use no memory area. One is £4.95, other is 007 Spy at £3.95, with free program to stop any machine code programs, and works with/without micro drive.

007 SPY £3.95

ZX GUARANTEED (DEPT ZX1),
29 CHADDERTON DRIVE, UNSWORTH,
BURY, LANCS
Tel: 061-766-5712

NEUBRAIN SOFTWARE. 3D graphics allows the creation of moving 3D images. Machine code vector drawing integer maths and 3D transformation routines allow rapid simulated motion through scenes, image rotation etc. Main-frame-like images on a micro for £9.95. Word Processor contains extensive machine code for high speed document reformatting etc. Save documents on cassette £8.95. Renumber handles goto, gosub etc. £4.95. All programs supplied as easily loaded listings to eliminate tape problems. Comprehensive user guide. Cheques to S. Gaymer, 16/18 Princes Street, Ipswich.

BBC copy protected Acornsoft tapes with master key. No more "locked" messages. Unprotected copy can be copied to disc if required. Works on ST*RSHP* C*MM*ND, SN**K*R, etc. Full instructions. Tape £5.00. To: Nicholas Benton, 1 Cow Lane, Steeple, Aston, Oxon.

ACCESSORIES

SPECTRUM TAPE ACCESSORIES

HIGH-SPEED LOADER - load and save at 3000 baud on a normal recorder with our short Speedyload program. Easy to use with any command. Cassette (48K) £3.95.
AUTOMATIC TAPE CONTROL - plugs in Spectrum cassette sockets for auto ON/OFF and LOAD/SAVE switching of one or two recorders. Operated by BASIC program or keyboard commands. Built-in BEEP amplifier with volume control, plus semi-auto switch for rewinding, etc. Black case. £19.95 + £1.50 P&P (£16.95 as kit).
BEEP AMPLIFIER - plugs in MIC socket, volume control, in black case. £5.95 + 85p P&P. Also available with recorder ON/OFF and LOAD/SAVE switches. £9.95 + £1.
TAPE CARE - cleaning cassette with built-in head de-magnetiser, and cleaning fluid. £1.95 + 50p P&P.
VIDEO EXTENSION LEAD - 4m. TV plug to socket. £1.85.
AERIAL SWITCH - saves unplugging TV, plug-in. £2.45.
MAINS LEAD - 9m. plug to 2 sockets. £3.85 + P&P £1.
CASSETTES - C5-480, C12-480, C60-360, 10% off for 10.
CASSETTE LABELS - blank, adhesive. 50-£1, 100-£1.90. Min. P&P 30p + 10p per item. Send SAE for details.

NESS MICRO SYSTEMS
100 Drakes Avenue, Inverness IV2 3SD

HARDWARE

NEUBRAIN

The professional micro computer for the price of the hobby machine. Delivery free. Call us for very special offer. Mail Order. Access.

Call **Stevenage (0438 812439)**

Anytime for the latest details of Newbrain Hardware, Software, Books, "Newbrain Dissected" Book £9.00, tape £9.95 and both £18.45. "Getting More from your Newbrain" £7.50. All include P&P. New Epson, CP80 and Juki printers.

ANGELA ENTERPRISES
4 Ninnings Lane, Rabley Heath,
Welwyn, Herts AL6 9TD.

FUTURE TECHNOLOGIES (PCT) 1 Hollybrook Rd, Shirley, Southampton, SO1 6RB
(Reg. Office. Callers By Appointment)
CBM 64K Computer £198
With Cassette & 2 Blank Tapes £242
VIC 20 Starter Kit £139
Cassette Alone - £44.90 - Tapes £1 each
Spectrum 16K - £99.95, 48K - £129.95
Also Atari, Texas, Accessories, Software
Cheque P.O. with Order
Send large SAE for Lists (23p Stamp)
Add £1 p&p for Orders under £50
All prices include VAT.

ASP
CLASSIFIED
01 - 437 1002
EXT 305

XMAS GIFTS

Micro-Users SOFTWARE T-SHIRTS and SWEATSHIRTS

- | | |
|------------|---------------------|
| 1 Apple | 6 I'm User Friendly |
| 2 Spectrum | 7 Have you seen |
| 3 Oric 1 | my Peripherals? |
| 4 Epson | 8 Z80A |
| 5 Invader | 9 6502 |

100% Cotton T-shirts in white, red or sky £3.25 each inclusive. Poly-cotton Sweatshirts in white or grey £5.50 each inclusive, small, medium, large and extra large sizes. Mail order only from:

One Per Cent Screens, Unit 12, Star Lane Estate, Great Wakering, Essex.
Xmas orders send first class return post.

SOFTWARE GAMES

GROVE SOFTWARE

Games for the Jupiter Ace with 16K

TBT 1 Mastermind + Bomber
TBT 2 Pairs + Submarines

£5.50 each inc p&p

SAE for Catalogue

Cheques and PO's to:

GROVE SOFTWARE
2 Grove Court, Oakfield Road,
Penge, London SE20 8RG.

NASCOM ACTION? Get it with Revenge of Drosophila! Fast Synchronised Animation, Scrolling Maze, 5 different Maze's to survive and 8 Game Variations. Requires 16K 1, 2 or 3 with NASGRA ROM (Ver. 3). Monitor Independent - Free Loader. Specify CUTS or NI format. £8 post free from: Garry Rowland, 24 Parsloes Avenue, Dagenham RM9 5NX.

UK 101 SOFTWARE - Frogger, Dominoes, Boston, Yahtzi, Connect 4, Lincs, Simon, Fireman, PF21, Pairs, Defuse. Other programs from 4K to 22K, colour or black/white with sounds. Send for details to Dr Gilchrist, 70 Skirbeck Road, Boston, Lincs PE21 6DG.

MICROTAN, Tanex, cased keyboard, 19" rack, power supply, X-bug. Cost £350. Offers over £150. Malvern 68865.

FOR SALE

TRS80 LEVEL 2 48K £160.
Acculab floppy tape system £80,
1/2/4K Eprom programmer £20,
81 Centronics Microprinter £50. All together £280. Tel: (027 74) 56145 after 6.15 pm.

TRS80 LEVEL 2 16K. Bounce - addictive arcade favourite £4.50. Drag Race - superb sound and graphics £4.50. Cassette, P&P included, or SAE for lists. R. Bowden, 6 Briarley Gardens, Woodley, Stockport SK6 1PJ.

ACORN ATOM 12+12K floating point manual leads games inc 747. £130 ono. Telephone after 7pm 01-274 8464 (Stockwell).

TRS80 LEVEL 2 48K in keyboard with line printer 7. Complete with plenty of books and software. £275 or ono. Tel: (0908) 606256.

NASCOM-2 cased, 48K RAM-B, NAS-SYS 1, NASGRA, NASPEN, toolkit, Imp printer, Imprint, spare ribbon, soundbox, Castle interface, tape recorder, associated manuals. £500. Woking 72739 evenings

TRS-80 V.G. extended cassette-based BDFORTH. 79-standard with over 170 commands. Only £12.50 including manual. T. Dorricott, 6 Gunton St., Peter's Ave., Lowestoft, Suffolk.

ADD-ONS

PRINT LINK 64

Interfaces a 64 directly to any printer with centronics input. The printer will respond to all the normal basic 4 commands. Supplied complete with instructions and interface cable... £26
We only sell one wordprocessor for the 64. We think it's the best!!!

Vizawrite 64. Text formatting word-processors disk or cartridge... £69.00
Vizaspell 64. Spelling checker with 30,000 word dictionary... £50.00
Vizawrite + Vizaspell. Combined

package (disk only) £99.00
Mikro Assembler. Write machine code with the ease of Basic..... £50.00
Arrow. Save and load to tape up to 7 times faster than normal..... £39.00
ViciTree. All toolkit and basic 4.0 commands + a lot more £49.00
Zoom. An excellent machine code monitor for the 64 £10.00
Graphix 64. Easy to use high resolution graphics from basic..... £10.00
Stix. A most addictive and compelling game. (Joysticks required) £17.35

Official orders from schools, universities, major companies etc are welcome. UK customers please add 15% VAT.

MICROPORT

7 Clydesdale Close, Boreham, Herts WD6 2SD.
Tel: 01 - 953 8385

CLASSIFIED ADVERTISEMENT — ORDER FORM

1.	2.	3.
4.	5.	6.
7.	8.	9.
10.	11.	12.
13.	14.	15.

When placing your ad, please state classification required. 35p per word.
Send to: ASP Classified, 145 Charing Cross Road, London WC2.

Tel: 01-437 1002

Name

Address

Tel.No.(Day)

Please place my advert in **COMPUTING TODAY** for issues commencing as soon as possible.

ADVERTISERS INDEX

AB&C	6
AGF	16
ASE Ltd	66
Abersoft	23
Alpha Bravo	16
Anirog	28
Buttercraft	60
Bytewell	48
CGL	7
C K Supplies	41
Calco software	16
Cambridge Learning	51
Crown	17
Datagrid	48
Dragon Data	27
Electronequip	61
Flight Electronics	22
Kobra Micro Market	49
Kuma	23
LEC	6
Level 9	71
Linco Data	14
Map 80	60
Mattel Aquarius	42,43
Mayfair Micros	48
MDA Modon	65
Microtan	17,65
Microvalue	10,11
Mogul	57
Molimerx	12
Oric Software	48
Orion Data	65
Owl Technical Services	60
PRE Electronics	6
Page 6	82
Premier	IBC
Racing & Football	54
Silica Shop	OBC
Sinclair	33,36
Sprakefield	23
Swanley	23
Twickenham	6
University Soft	60
Viglen	IFC

Buying an ATARI 600XL?

or already a 400/800 owner?

THEN YOU NEED

PAGE 6

PAGE 6 Magazine is just for you. Programs, utilities, articles on the special features of the Atari, beginners hints & tips — it's all in **PAGE 6** and it's all for Atari 400/600/800 computers.

PAGE 6 is published bi-monthly. The subscription is £6.00 per annum U.K./£8.75 Europe/£15 U.S.A./£16 Elsewhere (Air Mail rates).

Subscribe today — don't miss out — or send £1 for a sample issue.

Send today (make cheque payable to ABACUS) to:

**Subscription Dept.
PAGE 6 MAGAZINE
18 UNDERWOOD CLOSE, PARKSIDE
STAFFORD
Tel. 0785 41153**

HOW DARE THEY!

If you see an advertisement in the press, in print, on posters or a cinema commercial which makes you angry, write to us at the address below. (TV and radio commercials are dealt with by the I.B.A.)

The Advertising Standards Authority. ✓
If an advertisement is wrong, we're here to put it right.

ASA Ltd, Brook House, Torrington Place, London WC1E 7HN.

DRAGON 32 OWNERS

Make your Dragon turn into a real computer with the new Double-Density Delta Disk System.

The Delta Disk System Gives You . . .

**DELTA
DISK
SYSTEM**

- An affordable disk system.
- Powerful Delta disk commands.
- Lets you produce and handle random access files as easily as serial files.
- Random sequential and indexed file handling.
- Simple plug into Dragon there are no HARDWARE MODS needed to run DELTA!
- Easily expandable 180K to 1.4 megabyte ON LINE storage.
- Full range of business utility and games software AVAILABLE NOW!

- The price you see is the price you pay. NO HIDDEN RAM upgrade costs.
- Uses under 2K of user – RAM as DELTA is held in EPROM.
- Enables programmer to easily produce applications Software which automatically starts up and operates without any intervention from the user.

**FULL
RANGE OF
BUSINESS
SOFTWARE
AVAILABLE.
SEND SAE
FOR DETAILS.**

DELTA CARTRIDGE – contains DELTA disk Operating System, User Manual, demonstration diskette . . .	£120.00
DELTA 1 – DELTA Cartridge, User Manual, a single-sided 40-track (180K) drive plus cable	£320.00
DELTA 2 – as DELTA 1, but with a single-sided 80-track (360K) drive	£355.00
Disk Interface cable (supplied with DELTA 1 or 2)	£9.95
ENCODER 09 assembler/disassembler/editor – Integral with DELTA	£24.95
HOME ACCOUNTS full home package for DELTA	£14.95
INFORM – Data Base Management System commissioned especially for DELTA Systems	£39.95

TOOLKIT FOR DRAGON 32

NEW

PREMIER'S ASTONISHING NEW TOOLKIT FOR THE DRAGON 32 PERFORMS THE FOLLOWING AMAZING FUNCTIONS:—

- FULL screen editor allowing copying, concatenating of lines etc. Fully linked to the DRAGON'S line editor.
- Eight PROGRAMMABLE KEYS – all easily accessed or checked.
- 25 full colour low-resolution graphics screens available with commands for instantly writing to any of them or swapping/moving. MAKES COLOUR ANIMATION AT MACHINE CODE SPEED a simple task.
- Full range of ERROR HANDLING commands with several RESUME options.
- OVER SIXTY NEW WORDS fully linked to your DRAGON BASIC – your new commands become built-in as soon as you plug in the TOOLKIT cartridge.
- VARIABLE GOTO/GOSUB commands, allowing routines to be called by name. Eg GOSUB TITLE or GOTO FINISH.
- Superb TRACE command which uses top right of screen only, thus leaving graphics/text intact.
- SEARCH and REPLACE commands for easier program modification.
- Comes complete with COMPREHENSIVE 40+ page MANUAL.

Available in CARTRIDGE or DELTA enhancement format .£29.95inc.

NEW

- DRAGON Fig FORTH ON DISK FOR DELTA • Executes up to 10 times faster than BASIC • Language extendable by user defined words • Words can even be defined using the FORTH assembler for maximum speed • BASIC and DELTA commands still available from FORTH • Source code stored and can be compiled from disk • FORTH can be saved to disk, including any new definitions ONLY £29.95 including MANUAL + Fig FORTH glossary + Model. Inc. VAT

SCRIBE FOR THE DRAGON 32

- FULL UPPER and LOWER CASE direct from the keyboard.
- An enlarged 42 x 24 screen display which gives a superb READABLE text.
- Full text display on hi-res screen.
- Automatic underline and reverse image.
- Up to 255 user-defined graphics.
- Precision character position command giving super/subscripts.
- Black on white text display option.
- A new Print @ command extending to 1008 thus almost doubling screen area.

ENCODER 09 FOR THE DRAGON 32

ENCODER 09 – is a full symbolic assembler using standard mnemonics and pseudo op-codes. Source code can be incorporated into BASIC programs. The monitor section contains commands to allow memory display, modification and execution. Memory block move, breakpoint handling, full disassembly and a full editor are only a few of its many features. The most powerful assembler/disassembler/editor available for the DRAGON 32. Available as either an integral DELTA fitment or in cartridge. Cartridge £29.95. Disk – see above.

HIPRINT FOR THE DRAGON 32

HIPRINT – screen dumper.

– will dump the entire contents of your DRAGON 32 high-res screen to a high resolution printer. Can be used for design, display etc (see left). Available at present for EPSON printers only. Other modules to follow shortly. Tape £7.95. DELTA disk £9.95.



PREMIER MICROSYSTEMS
208 Croydon Road, Anerley, London SE20 7YX
Telephone 01-659 7431 or 778 1706
Dealer and export orders welcomed.

POSTAGE and PACKING
Tapes 1–2 95p, 3+ £1.25.
Cartridges £2.50
Drives or Disk packages £4.50
ALL PRICES INCLUDE VAT.
Send SAE for full catalogue.
ALLOW 28 DAYS FOR DELIVERY.



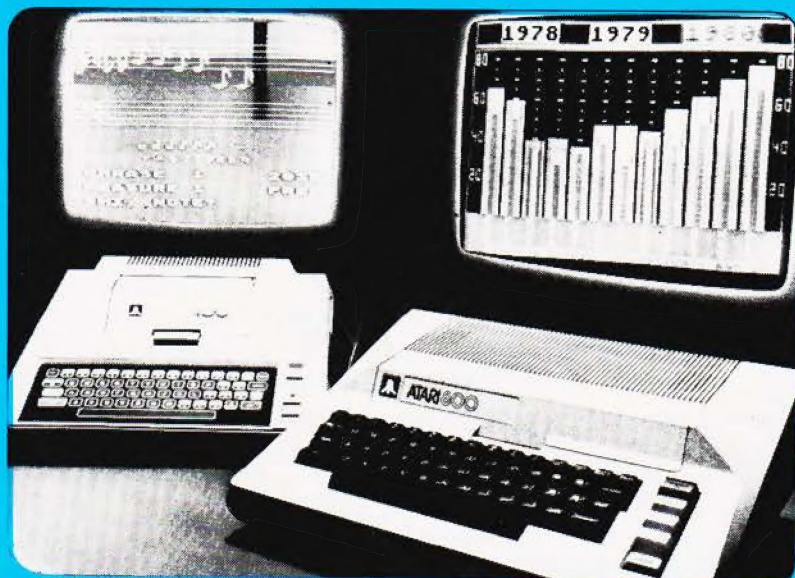
100 FREE PROGRAMS

FROM SILICA SHOP — WITH EVERY PURCHASE OF AN

ATARI 400

800

ATARI



ATARI PRICES REDUCED!

We at Silica Shop are pleased to announce some fantastic reductions in the prices of the Atari 400/800 personal computers. We believe that the Atari at its new price will become the U.K.'s most popular personal computer and have therefore set up the Silica Atari Users Club. This club already has a library of over 500 programs and with your purchase of a 400 or 800 computer we will give you the first 100 free of charge. There are also over 350 professionally written games and utility programs, some are listed below. Complete the reply coupon and we'll send you full details. Alternatively give us a ring on 01-301 1111 or 01-309 1111.

ATARI 400
with 16K **£99**

ATARI 400
with 48K **£158**

ATARI 800
with 48K **£249**

400/800 SOFTWARE & PERIPHERALS

Don't buy a T.V. game! Buy an Atari 400 personal computer and a game cartridge and that's all you'll need. Later on you can buy the Basic Programming cartridge (£35) and try your hand at programming using the easy to learn BASIC language. Or if you are interested in business applications, you can buy the Atari 800 + Disk Drive + Printer together with a selection of business packages.

Silica Shop have put together a full catalogue and price list giving details of all the peripherals as well as the extensive range of software that is now available for the Atari 400/800. The Atari is now one of the best supported personal computers. Send NOW for Silica Shop's catalogue and price list as well as details on our users club.

THE FOLLOWING IS JUST A SMALL SELECTION FROM THE RANGE OF ITEMS AVAILABLE:

ACCESSORIES Cables Cassettes Diskettes Joysticks Le Stick - Joystick Misc Supplies Paddles ADVENTURE INT Scott Adams Adv No 1 Adventureland No 2 Pirate Adv No 3 Mission Imp No 4 Voodoo Cast No 5 The Count No 6 Strange Ody No 7 Mystery Fun No 8 Pyramid of D No 9 Ghost Town No 10 Sav Island 1 No 11 Sav Island 2 No 12 Golden Voy Angle Worms Deflections Galactic Empire Galactic Trader Lunar Lander	Mountain Shoot Rearguard Star Flite Sunday Golf AUTOMATED SIMULATIONS Crush Crumble Cmp Datestones of Ryn Dragons Eye Invasion Orion Rescue at Rigel Ricochet Star Warrior Temple of Apsai Upper Reaches Aps BOOKS Basic Ref Manual Compute Atari DOS Compute Bk Atari Compute Magazine De Re Atari DOS Utilities List DOS2 Manual Misc Atari Books Op System Listing Wiley Manual	BUSINESS Calculator Database Managemt Decision Maker Graph-It Invoicing Librarian Mort & Loan Anal Nominal Ledger Payroll Personal Finl Mgmt Purchase Ledger Sales Ledger Statistics 1 Stock Control Telelink 1 Visicalc Weekly Planner Word Processor CRYSTALWARE Beneath The Pyram Fantasyland 2041 Galactic Quest House Of Usher Sands Of Mars Waterloo World War III	DYNACOMP Alpha Fighter Chompelo Crystals Forest Fire Intruder Alert Monarch Moonprobe Moving Maze Nominos Jigsaw Rings of The Emp Space Tilt Stud Poker Triple Blockade EDUCATION from APX Algebraic Atlas of Canada Cubbyholes Elementary Biology Frogmaster Hickory Dickory Inst Comptg Dem Lemonade Letterman Mapware	Maths-Tac-Toe Metric & Prob Solvg Mugwump Music Terms/Notatn Musical Computer My First Alphabet Number Blast Polycalc Presidents Of U.S. Quiz Master Starware Stereo 3D Graphics Three R Math Sys Video Math Flash Wordmaker EDUCATION from ATARI Conv French Conv German Conv Italian Conv Spanish Energy Car European C & Caps Hangman Invit To Prog 1/2/3 Kingdom Music Composer	Scream States & Capitals Touch Typing EMI SOFTWARE British Heritage Cribbage/Dominos Darts European Scene Jig Hickory Dickory Humpty Dumpty Jumbo Jet Lander Snooker & Billiards Submarine Commdr Super Cubes & Tilt Tournament Pool ENTERTAINMENT from APX Alien Egg Anthill Attank Avalanche Babel Blackjack Casino Block Buster Block 'Em Bumper Pool	Castle Centurion Checker King Chinese Puzzle Codecracker Comedy Diskette Dice Poker Dog Daze Domination Downhill Eastern Front Galahad & Holy Gr Graphic/Sound Jax-O Jukebox Lookahead Memory Match Midus Touch Minotaur Outlaw/Howitzer Preschool Games Pro Bowling Pushover Rabbotz Reversi II Salmon Run 747 Landing Simul Seven Card Stud	Sleazy Adventure Solitaire Space Chase Space Trek Sultans Palace Tact Trek Terry Dog Daze Domination Downhill Eastern Front Galahad & Holy Gr Graphic/Sound Jax-O Jukebox Lookahead Memory Match Midus Touch Minotaur Outlaw/Howitzer Preschool Games Pro Bowling Pushover Rabbotz Reversi II Salmon Run 747 Landing Simul Seven Card Stud	Jawbreaker Mission Asteroid Muskattack Threshold Ulisses/Golden Fl Wizard & Princess PERIPHERALS Centronics Printers Disk Drive Epson Printers Program Recorder RS232 Interface Thermal Printer 16K Memory RAM 32K Memory RAM PERSONAL INT from APX Adv Music System Banner Generator Blackjack Tutor Going To The Dogs Keyboard Organ Morse Code Tutor Personal Fitness Prg Player Piano Sketchpad	PROGRAMMING AIDS from ATARI Assembler Editor Dembler (APX) Microsoft Basic Pascal (APX) Pilot (Educator) Programming Kit SANTA CRUZ Basics of Animation Bobs Business Display Lists Graphics Machine Kids 1 & 2 Horizontal Scrolling Master Memory Map Mini Word Processor Page Flipping Player Missile Gr Player Piano Sounds Vertical Scrolling SILICA CLUB Over 500 programs write for details
--	---	--	--	--	---	---	--	--	---

FOR FREE BROCHURES - TEL: 01-301 1111

FREE LITERATURE

I am interested in purchasing an Atari 400/800 computer and would like to receive copies of your brochure and test reports as well as your price list covering all of the available Hardware and Software.

Name.....

Address.....

Postcode.....
CT184 —Computing Today

SILICA SHOP

For free literature and reviews on our range of electronic products, please telephone 01-301 1111. To order by telephone, just quote your name, address, credit card number and order requirements and leave the rest to us. Post and packing is FREE OF CHARGE in the UK. Express 24 hour delivery available at an additional charge.

- **SHOP DEMONSTRATION FACILITIES** - we provide full facilities at our shop in Sidcup, Middlesex, Saturday 10am to 5.30pm (closing Thursday 1pm - Friday 6pm).
- **MAIL ORDER** - we are a specialist mail order company and are able to supply goods directly to your door.
- **MONEY BACK GUARANTEE** - if you are not satisfied with your purchase, you may return it to us within 15 days. On receipt of the goods in satisfactory condition we will give you a full refund.
- **PART EXCHANGE SECOND HAND MACHINES** - we offer a part exchange scheme to trade in many makes of T.V. games for personal computers.
- **COMPETITIVE PRICES** - our prices, offers and services are very competitive. We are never knowingly undercut and we normally match any lower price quoted by our competitors.
- **MULTIPLE ADDRESSES** - available on the suitability of various computers.
- **AFTER SALES SERVICE** - available on all computers sold or guaranteed.
- **VAT** - all prices quoted above include VAT at 15%.
- **CREDIT FACILITIES** - we offer credit over 12, 24 or 36 months (please ask for details).

SILICA SHOP LIMITED
Dept. CT184 1-4 The Mews, Hatherley Road, Sidcup,
Kent DA14 4DX Telephone 01.301 1111 or 01-309 1111